Expanding and Developing Markets For Used and End-Of-Life Electronics

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With Financial Assistance From
The Missouri Department of Natural Resources

Spring 2002

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Executive Summary

The objective for this project is to provide information and recommendations that would help guide the state of Missouri to make informed decisions regarding the most efficient and fiscally responsible means of supporting the management of obsolete and otherwise unused electronics. This, it was believed, would result in helping to expand and sustain markets for obsolete and end-of-life electronics. To accomplish this task, the researcher performed the following tasks:

A. Identify current quantities of targeted obsolete electronics, gauge the attitudes and actions of Missouri constituents regarding the use and management of the targeted materials, and identify current businesses, programs and initiatives within the state focusing on the management of these targeted materials.

B. Identify the major concerns and challenges associated with developing obsolete electronics' management strategies and markets.

C. Review national programs and initiatives focusing on issues of electronics design, collection and processing, and regulation.

D. Review and evaluate two common methods of obsolete electronics collection and processing: 1) collection programs, and 2) permanent facility.

The scope of this study focuses primarily on the use and diversion of computers, CRT-monitors and CRT-televisions, and computer peripherals – referred to in this report as "targeted electronics". These items were selected due to their potential for generating hazardous waste, their shared commonalities in collection and processing, and because they are the focus of national initiatives, as well as current and future legislation and regulation.

It is the opinion of the researcher that as Missouri considers enhancing existing or developing new management programs, the state should also consider ways communities and constituents can benefit from the reduction, reuse and recycling of electronic products. For example, how can municipal electronic collection programs, or existing for-profit businesses, or future obsolete electronics initiatives incorporate job or educational training into their strategies? Hopefully, solving the end-of-life electronics problem will be more than just keeping the targeted electronics out of the landfill and developing new markets. It seems the task at hand has the potential for a variety of social entrepreneurial endeavors that can build the assets of individuals and communities.

Based on adjustments made to national statistics reflecting Missouri's demographics and survey results, an estimated 15 million computers, peripherals, CRT-monitors and televisions will become obsolete in Missouri between 2001-2007. This equals just over 436,000 tons. Of the approximately 15 million units becoming obsolete during this time period, only 2 million units (or 50,000 tons) will be reused or recycled. This leaves 13 million units (386,000) unaccounted for.

It is estimated that 84% of the computer electronics currently being collected and processed in Missouri come from businesses, while conversely; only 16% come from households. National and regional estimates indicate that businesses account for 54.9% of computer electronics ownership, while households account for 45.1%. While the percentage of ownership between businesses and households is not that dramatically different, the reported percentage of obsolete electronics collected from the two groups is. The reason for this inconsistency is economics. In general, it is more expensive to collect and process household electronics. Collection expenses, consistency of product, quality of product and other processing expenses make household electronics a less desirable commodity.

If the estimated total of obsolete electronics generated in Missouri between 2001-2007 is managed based on what Missouri households and businesses report as the methods they have used in the past, the results would be:

- 4 million computer electronics and televisions will be donated.
- 3.8 million computer electronics and televisions will be thrown away.
- 3 million computer electronics and televisions will be sent to reuse or recycling enterprises.
- 4.7 million computer electronics and televisions will be stored, traded, or given away to other than charities.

In Missouri, the immense quantity of these products becoming available has proven to put a heavy burden on those most involved with their management – particularly municipalities and governments involved in solid waste management. Finding solutions, which make sense environmentally, economically, and socially should take into account the following challenges:

- National and world markets, pricing structures and distribution systems will influence market development, particularly end-markets for the obsolete electronics generated in the state of Missouri. In addition, decisions made on the national level regarding electronics management and legislation and regulation will influence every state's management strategies, including Missouri's.

- Missouri's electronics infrastructure is in the formative stages of development. Current collection and processing alternatives are insufficient and often times not known to all stakeholders and decision makers. Currently, legislation and regulation of electronics, particularly CRT's, is unclear to many individuals and businesses.

- The volume alone of obsolete electronics is not the problem. Electronic products contain a multitude of hazardous materials, commonly referred to as E-waste, which affect their economic potential. It is estimated that although electronics make up only 1%-3% of landfill content, they are responsible for 50%-75% of the heavy metals found in landfills.

- The revenues generated from the recycling of electronics continues to drop, while expenses edge higher. In comparing prices paid by recyclers for electronics in the years 2000 vs. 2002, prices dropped 19%-57% (depending on

the item) for electronics in 2002. In 2000, a truck with a 33,300-pound load of recyclable electronics would have generated $3,781 in recycling revenue, while this same load in the first months of 2002 would only bring $2,169 – a decline of 43%.

There are successful markets, industries, and programs targeting obsolete electronics products in Missouri. Many of these initiatives focus on reusable commodities, leaving those electronics, which are harder to process and find markets for a greater challenge to all. Additionally, state efforts have had a bearing on only a small percentage of the materials requiring attention. Also, most initiatives are independent and localized to a specific city or county. Often times, a successful electronics program in one part of the state is unknown by other state constituents. As a result, the expertise and experience of successful efforts are under utilized, which may result in a portion of the funding dispersed being allocated to reinventing the wheel. And like many states, Missouri does not have a "gate-keeper" or central clearinghouse responsible for collecting and disseminating information and supporting efforts to handle obsolete electronics. Like many states, the most common electronics initiatives are in the form of collection models or permanent/ongoing facilities or programs. This report studied both models and a summary of the results are as follows.

Collection Programs

Although collection models are a common strategy for "curbing" the flow of obsolete electronics, the cost per ton to manage the materials is very high. In addition, the cost to administer and conduct the collection events usually falls on the shoulders of government funded solid waste programs. Collection models are usually one of three types: ongoing drop-offs, a single or series of special drop-off events, or curbside pickup. Most electronic collection events do not incorporate reuse and repair into their model; resulting in most, if not all, collected equipment being processed by outside recyclers. This strategy does not take advantage of the potential income generated from reusable electronics.

Only recently have two programs, measuring the effectiveness of the collection model, occurred in Missouri: the Saint Louis County Department of Health's Waste Management Branch Consumer Electronics Product Stewardship Program (DOH), and The Mid-America Regional Council's Solid Waste Management District (MARC) Electronics Collection Events. This study compared the results of DOH's and MARC's collection programs with other national collection programs. Nationally, the average cost to set up a program event was $3,086, with 80% of respondents reporting set up costs to be under $5,000. Set up costs depends on the model, the population served and tenure of the program. Nationally, the average cost per ton to collect electronics is: $304 for curbside programs, $464 for special events, and $448 for ongoing drop-offs. *DOH's program cost $17,853, making the cost per ton collected $1,480. MARC's three events cost a total (revenue less expenses) of $11,055, or $580 per ton. It is important to note that both were start-up programs, incurring initial costs that would be minimized if collection events were continued. In addition, DOH did not charge fees to participants, while conversely the MARC program did, generating $6,605 in collection fees.*

Facility Based Models

Obsolete and end-of-life electronics management is also accomplished by permanent facilities operating on a daily basis as for-profit businesses or nonprofit organizations. Two models are described for this report, an Electronics Demanufacturing/Recycling facility, and a Community Electronics Reuse Center model.

The Electronics Demanufacturing/Recycling model is based on a single-story 40,000 square foot facility processing 8,046 tons of materials per year. It will employ 18 full time staff and utilize a pool of 25-35 volunteers. It is not recommended that the Electronics Demanufacturing/Recycling model fully process CRT's, but rather charge for their collection and ship them to a CRT demanufacturing facility. Additionally, in order to compete in the market place, it is recommended that existing or future electronics demanufacturing facilities offer asset recovery services to their clients such as inventory management and information removal. Electronics demanufacturing and recycling is highly competitive, with many existing facilities in the region.

It is estimated that the Electronics Demanufacturing/Recycling model will realize $1,736,404 in revenues, and $1,895,654 in expenses and set up cost its first year of operation. Net loss will be -$159,250. First year projections merge set-up costs and first time major equipment purchases with operating income and expenses, and does not report any unearned income in the form of grants.

The second model, a **Community Electronics Reuse Center (CERC)** will combine the reuse, repair and redistribution of obsolete electronics with community development in the form of educational, economic, social, and vocational programs and opportunities. This model will promote using four centers or businesses (preferably existing) throughout Missouri to collect and process 8,046 tons of electronics per year. The minimal size for each CERC facility is 15,000 square feet. Each center will employ 11 full time staff, including a Volunteer and Community Coordinator and a Job Coach.

It is estimated that the Community Electronics Reuse Center model, (all four centers combined) will realize $2,271,512 revenues, and $2,364,308 in expenses and start up costs its first year of operation. Net loss is projected to be -$23,199 per Center, or -$92,796 for all four CERC's. First year projections merge set-up costs with operating income and expenses, and does not report any unearned income in the form of grants.

Recommendations

Based on the premise that the best way to support and encourage obsolete and end-of-life computer related electronics market development is to first influence product design and reduce toxicity, encourage legislation and regulation for the targeted materials, and utilize social-entrepreneurial ventures to provide management services, the following recommendations are made:

Recommendation #1: For the state of Missouri to continue participation in initiatives supporting product design changes. It is this researcher's belief that product design, resulting in safer and easier to manage products, precedes all other efforts. Redesigning products to reduce their hazardous content and making them easier to dismantle and upgrade is a future investment impacting all other environmental, governmental, economical and social considerations. OEM's and retailers should not be asked to limit their consumer activity, but demands should be placed on them to make a

safer product, which has value as it moves through its life cycle. Market development is based on having a commodity, which generates activity resulting in (future) profits. Right now, the market is speaking loud and clear – the commodity is too dangerous and expensive to collect and process, and profits are too low.

Recommendation #2: Quickly consider and implement strong legislation and regulation of certain electronics. Massachusetts is a good example of how legislation and regulation can have a positive effect on market development. Massachusetts has shown how a state's infrastructure-development-plan, (which includes removing the hazardous waste label from intact CRT collection and processing, achieving a disposal ban on CRT's, and providing incentives for recyclers and reusers), gives a boost to the industry. Missouri needs to quickly follow suit, and support an infrastructure that is safe for the environment and encourages market development.

Recommendation #3: Create a gatekeeper and central database for the collection and dissemination of all information related to this topic. Missouri is no different than many other states in that there is so much activity going on regarding the topic of obsolete and end-of-life electronics, that it is hard to keep up on the industry. The gatekeeper can function as the one-stop-shop for collecting and disseminating information, as well as identifying and coordinating end-markets for the targeted materials.

Recommendation 4: Create a task force or stakeholder group to help define the state of Missouri's obsolete and end-of-life management strategies, mission statement, and objectives. Missouri has a wealth of collective knowledge regarding the issues, programs and businesses currently managing the targeted electronics; and a SWMP that has shown initiative and ingenuity in its approach to funding and supporting management efforts. It will also be important to include representation from Kansas and Illinois. Both states border major Missouri metropolitan areas, and the boundaries preventing the flow of targeted electronics is virtually invisible. Continuing to coordinate efforts and stakeholder interests, and then formulizing a mission statement and set of goals, which includes but is more than the sum of the each stakeholders' interest, is crucial to the process. In addition, this approach will help manage the collective resources allocated to this process. This will provide standards and criteria for all stakeholders' interests and future solutions and strategies to be weighed against. And, having a common mission and set of objectives will provide focus for funders such as the SWMP, assisting them in allocating their dollars and funding opportunities to a common strategy.

Recommendation #5: Support consumer education and information regarding the topic. Based on the surveys conducted for this project, 67% of households and 40% of businesses report <u>not</u> being aware of the hazards contained in computer electronics and televisions. These numbers are surprising high and reinforce the need for information, which will help consumers become better stewards of the products they purchase. Overseeing this task can become part of the gatekeeper position described above.

Recommendation #6: Evaluate the economics of collection-model programs, and consider supporting an Electronics Demanufacturing Recycling model or a Community

Electronics Reuse Center model. This project studied two facility models, an Electronics Demanufacturing Recycling model, and a Community Electronics Reuse Center model. Although both models have proven in the past to be successful, the model, which might make the most logistic and economic sense, is the Community Electronics Reuse Center (CERC) model. The reasons the researcher is biased towards this model include:

1) It appears that it is not a lack of demanufacturing and recycling facilities that is the problem; rather it is the lack of end-markets for end products that is the challenge. Based on the information acquired for this project, existing demanufacturing and recycling facilities are able to handle their current capacity as well as future increases of targeted materials. The state of Missouri is conveniently located to such facilities as its own Doe Run, and regional facilities such as United Recycling, in West Chicago, Illinois; Asset Recovery in St. Paul, Minnesota; or Blue Star Electronics, in Colorado Springs, Colorado, to name a few.

2) Start-up costs, excluding salaries, for a single demanufacturing facility exceed the start-up costs for four reuse facilities. In addition, the CERC model holds the greatest potential for utilizing existing for-profit businesses and nonprofit organizations, thus reducing expenses, including initial set up costs. If existing enterprises are not utilized, the CERC model can be set up incrementally, one center at a time, requiring less initial investment and minimizing risks. Economic benefits to communities will be more wide spread with the CERC model.

3) Prices paid for reusable computer electronics do not fluctuate as much as they do for recyclable computer electronics. Rather than the continual drop in prices paid by recyclers, reusable electronics, with all else being equal, are steady. The consumer usually pays the same price but gets a faster-smarter product for the same amount of money. This adds a certain degree of stability to the reuse model.

4) Electronics reuse models tend to create a program synchronicity unable to be obtained by electronics demanufacturing and recycling models. Reuse models, linked to community development, are attractive to a variety of funders, businesses and governments willing to assist reuse initiatives, or fund educational, vocational and social related programs.

In conclusion, there is no new “twist” or clever marketing strategy or advertising promotion, which can bridge the gap between the overwhelming and continual supply of expensive to manage obsolete electronics and the environmental and economic difficulties their hazardous contents produce. Successfully expanding existing, or developing new, end-markets for obsolete and end-of-life electronics in Missouri will result from bringing together the many inter-related issues covered in the recommendations above.

I. Introduction

The use of electronic equipment, particularly that of computers, CRT-monitors, CRT-TV's, and computer peripherals has become an all-pervading, and ostensibly, a required part of the daily lives of Missouri citizens. For better or for worse, computers and other electronics has become a required tool for Missouri citizens to perform job related tasks, for educational purposes, for commerce and entertainment. As experienced across the country, developing new uses for technology and the drive to do more, faster, predicts that technological advances will result in the rise of per capita purchasing of new electronics by Missouri citizens. Consequently, the advances and benefits that emerge from faster, smarter and less expensive electronics also give rise to an "industry of obsolete electronics".

As Missouri takes responsibility for developing and implementing management solutions for current and future quantities of electronics potentially entering its' landfills, or being shipped off to become another state's or country's problem, it should be kept in mind that Missouri does not exist in a vacuum. Solutions for effectively managing obsolete electronics and market development are influenced by many factors outside Missouri's borders. National (and world) markets, regulatory issues, funding, consumer trends, and national product stewardship initiatives are all important factors potentially shaping the decisions the state of Missouri will make.

The best practices for properly managing the sometimes-unfathomable volumes of electronic cast-offs are still being negotiated among stakeholders. On a national level, there is movement towards a system that will ask consumers and manufactures, as well as other stakeholder groups, to take ideological and financial responsibility for: 1) dealing with the here and now, and figuring out what to do with obsolete electronics accumulated up to this point; and 2) instituting policy, practice and product design to curb the growth of future obsolete electronics headed into the waste stream. It is hopeful that a national strategy will positively influence state efforts.

The immense quantity of these products becoming available puts a heavy burden on those involved with their management and affects the supply side of market development. Based on national statistics, it is projected that 334 million computers will become obsolete in the United States during the years 2001 through 2007. Of those, only 39 million will be reused or recycled. During that same period of time, the state of Missouri will be faced with an estimated 15 million units (436,000 tons) of combined obsolete electronics including computers, peripherals, CRT-monitors and televisions. It is projected that of the 15 million total, only 2 million will be reused or recycled.

Missouri's share of obsolete electronics becomes part of the national statistic for electronic waste (E-waste) being generated. And, national statistics are becoming more of a global concern as estimates suggest that between 50%-80%

of all E-waste collected in the western United States is not recycled domestically, but rather shipped to Asia. Sadly, our willingness to share our cast-offs with other countries is not always as environmentally, economically, or socially beneficial to the recipient countries as we have been asked to believe in the past. Although there are both exporters and recyclers in the United States and processors in recipient countries practicing good industry stewardship, there also appears to be a prevailing attitude and practice that shipping off our electronic waste problems to others is tolerable, at any cost.

Electronic products contain hazardous materials which pose significant environmental and health hazards. It is estimated that 50% to 75% of the heavy metals found in landfills come from obsolete electronic equipment. Compounds such as lead, cadmium, mercury, brominated flame-retardants, and chromium VI are found in the materials included in computers and peripherals. When computers and other electronic products are sent to the landfill or incinerated, there is the potential for water contamination and toxic air emissions.

The cathode ray tube (CRT) glass found in computer monitors and TV's contains 2.8-8 pounds of lead. Fees range from $10-$14 to properly transport and process each unit. A study conducted by the U.S. EPA ("Household End-of-Life Electronic and Electrical Equipment," February 1998) found that plastics make up one-third of the weight of collected consumer electronics. This presents a concern as the resins and contaminants present in electronics plastic doesn't always make it feasible to separate the plastics into marketable streams.

In addition to volume and hazardous content, many conditions present themselves as economic impediments for successful obsolete electronic markets. Labor, transportation, and regulatory requirements also cause expenses to prevail over revenues when collecting and processing obsolete electronics. Additionally, an older piece of electronic equipment is a different commodity with varying economic and social value, and requiring different management methods, as it goes from being a reusable commodity to being considered trash. Businesses and programs handling electronics, which are a reusable commodity, are able to maximize values and earned revenues, while those focusing on electronics, which are to be recycled, or which become waste, are able to realize less or no value.

There are successful markets, industries, and programs targeting obsolete electronics products in Missouri. Many of these initiatives focus on reusable commodities, leaving those electronics, which are harder to process and find markets for a greater challenge to all. Additionally, state efforts have had a bearing on only a small percentage of the materials requiring attention. Also, most initiatives are independent and localized to a specific city or county. Often times, a successful electronics program in one part of the state is unknown by other state constituents. As a result, the expertise and experience of successful efforts are under utilized, which may result in a portion of the funding dispersed

being allocated to reinventing the wheel. And like many states, Missouri does not have a “gate-keeper” or central clearinghouse responsible for collecting and disseminating information and supporting efforts to handle obsolete electronics

While understanding the major challenges coupled with expanding existing and developing new markets for managing obsolete electronics, the Missouri Department of Natural Resources Solid Waste Management Program funded “The Expanding and Developing Markets For Used and End-Of-Life Electronics Project”. The project was initiated to learn more about what is, and what should be happening to the vast quantities of obsolete electronics potentially entering Missouri’s waste stream. The project began in January of 2001 with the intent of evaluating user trends and opinions, current electronics’ businesses and programs, current and anticipated volumes of targeted obsolete electronics, and the challenges the state of Missouri will most likely encounter when considering future management markets and management strategies.

At the onset, the principal objective of the project was to provide information that would help guide the state of Missouri to make informed decisions regarding the most efficient and fiscally responsible means of supporting the management of obsolete and otherwise unused electronics. This, it was believed, would result in helping to expand and sustain markets for obsolete and end-of-life electronics. It is the opinion of the researcher that as Missouri considers enhancing existing or developing new management programs, the state should also consider ways communities and constituents can benefit from the reduction, reuse and recycling of electronic products. For example, how can municipal electronic collection programs, or existing for-profit businesses, or future obsolete electronics initiatives incorporate job or educational training into their strategies? Hopefully, solving the end-of-life electronics problem will be more than just keeping stuff out of the landfill and developing new markets. It seems the task at hand has the potential for a variety of social entrepreneurial endeavors that can build the assets of individuals and communities.

II. Scope of Study

The purpose of the project is to provide the Missouri Department of Natural Resources Solid Waste Management Program with data and information so that informed decisions regarding the best solutions for the management of obsolete electronics can be made. To accomplish this task, the researcher believed that the following information would be required:

A. Identify current quantities of targeted obsolete electronics, gauge the attitudes and actions of Missouri constituents regarding the use and management of the targeted materials, and identify current businesses, programs and initiatives within the state focusing on the management of these targeted materials.

B. Identify the major concerns and challenges associated with developing obsolete electronics' management strategies and markets.

C. Review national programs and initiatives focusing on issues of electronics design, collection and processing, and regulation.

D. Review and evaluate two common methods of obsolete electronics collection and processing: 1) collection programs, and 2) permanent facility. In the context of this, review major challenges.

E. Make recommendations

The range of electronic products comprises a multitude of categories, including computers, computer peripherals, televisions, kitchen appliances, miscellaneous office equipment, toys, musical instruments, hospital equipment, telecommunication equipment, and other numerous consumer and business electronics parts and components. The scope of this study focuses primarily on the use and diversion of computers, CRT-monitors and CRT-televisions, and computer peripherals – referred to in this report as "targeted electronics". These items were selected due to their potential for generating hazardous waste, their shared commonalities in collection and processing, and because they are the focus of national initiatives, as well as current and future legislation and regulation.

Data collected in Missouri is divided into the following sections:

A. Households using computer equipment.
B. Businesses using computer equipment.
C. Dealers and processors collecting and selling used computer equipment.
D. Dealers selling new computer equipment.
E. Households using televisions.
F. National data from which Missouri statistics are derived.

G. Missouri statistics on new computer electronics shipped and becoming obsolete and recycled, and televisions becoming obsolete and recycled.
H. Estimates of what Missouri constituents will do with the obsolete targeted materials from 2001-2007.
I. Surveys with Solid Waste District Planners.

III. Methodology

A. Introduction

To determine current usage and obsolescence, and then forecast the future usage and equipment becoming obsolete is a science of estimations. To obtain such data would first involve establishing comprehensive and identical methods for the stakeholders interviewed to measure the amounts of the targeted materials used, diverted or thrown away; and then conduct similar information gathering on a regular basis over an extended period of time - preferably years. Due to the time frame for this project, and the fact that the overwhelming majority of stakeholder groups interviewed in Missouri do not systematically measure targeted materials, this type of data was not obtainable. Instead, to forecast current and future amounts, estimations were determined by utilizing published data from other reputable and informed sources, then projecting Missouri's "share" through pro-ration based on state demographics, and the application of historical trends and survey results.

B. National Data and Statistics

The National Safety Council's (NSC) 1999 "Electronic Product Recovery and Recycling Baseline Report – Recycling of Selected Electronic Products in the United States", was utilized as the primary source for establishing the starting point for new units shipped, units becoming obsolete, and obsolete units being recycled. The researcher, accounting for current estimations and consumer trends, then amended NSC's data.

For example, NSC's Table 6 (See Appendix I): "Obsolete Personal Computers in the United States, 1997-2007", estimates, (based on information from Appliance Magazine, 1998: Stanford Resources), the number of new personal computers shipped during 1992-2007. To then estimate the number of PCs predicted to become obsolete, NSC utilized a lifespan model that made assumptions regarding the amount of time a PC would remain "useful" to its original owner. At the time of NSC's 1999 report, their prediction for the number of new units shipped in the year 2001 was 49,900,000, and their lifespan estimation for new units shipped in 2001 was 2.4 years. For this report, it was estimated, using data from a combination of sources including the International Data Corporation and the U.S. Consumer Electronics Sales & Forecasts Report, that the number of new units shipped in 2001 was closer to 43,800,000. And, based on the indications that users are holding on to computers longer, the lifespan for computers shipped for 2001 is estimated to be 2.8 years.

C. Differentiating Between Household and Business Users

The researcher believed it important to differentiate between the trends and behaviors of Missouri's household and business users. Information and attitudes regarding each groups' specific computer equipment usage, and methods used to manage the obsolete targeted electronics was surveyed. In order to establish a baseline for the number of both household and business users in Missouri,

which would then enable the researcher to determine percentage factors from which to generate estimations, NSC's statistics were weighed against the following information:

1. Data from a September 21, 2001 U.S. Census Bureau report describing national computer use in households for the year 2000, and a March 11, 2002 Computer Industry Almanac report researching PCs-in-use for the year 2001. These are utilized to estimate the number of computers-in-use by both households and businesses nationally. Based on this data, and consistently utilized throughout this project, a factor of 45.1% is used as the percentage of computer related electronics used by national households, and 54.9% utilized by national businesses. Also taken into consideration is the U.S. Census Bureau's factoring of regional differences, and data from the Computer Industry Almanac. For the purpose of this study, "business users" also include government and educational users. The researcher was unable to find reliable data reporting total governmental and educational use separate from general business use. Only households were surveyed regarding television use and obsolescence.

2. To then calculate the number of household and business users separately in Missouri, the same U.S. Census Bureau information is utilized to determine that Missouri's population of 5,595,221 is 1.99% of the total 281,421,096 United States population; and Missouri's total of 144,874 nonfarm establishments is 2.07% of the national total of 7,008,444. Based on this formula, the assumption is made that any national data pertaining to electronics use, trends or disposal can be factored by 1.99% to determine Missouri's prorated household share, and 2.07% for Missouri's business share.

3. The same factors are then used to estimate and compare Missouri statistics for the years 2001-2007 regarding: 1) new computer equipment shipped; 2) computer equipment and televisions becoming obsolete; and 3) computer equipment and televisions becoming obsolete and not recycled. It is recognized by the researcher that assumptions based on prorated calculations are only reasonable and close approximations, as they do not take into account all regional differences and merge data from various sources.

D. Surveys and Data Collection

The study identified and collected information from five major stakeholder groups, including 220 households consumers, 155 business consumers, 25 establishments in the business of collecting and reselling used computer

equipment, 25 establishments in the business of selling new computer equipment, one secondary processor located in Missouri, and the Missouri Solid Waste District Planners. All surveys, with the exception of those with District Planners, were conducted by phone. District Planners were contacted by email and provided with a summary of the project and an on-line questionnaire to fill out and submit.

Phone surveys were chosen due to the potential for completion, the ability to clarify questions, and the minimal follow-up-time required. Responses were written down and later tallied by the researcher and categorized by range or type. Although this method did prove effective, the survey's format permitted the interviewer to prompt a respondent, and possibly influence the respondent's answer.

All phone surveys with household and business users were conducted within Jackson, Clay, and Platte counties. The sample group for the household surveys was developed by utilizing infoUSA's Select Phone database. For the household surveys, geographic areas were targeted to represent a sampling of metropolitan, suburban and rural areas. Then, within these targeted areas, phone numbers were chosen randomly. Only residents 18 years and older were selected to complete the phone survey.

The businesses contacted to participate in the phone surveys were selected in a similar way to the household users, but allowed for categorization by employer size. The researcher wanted to obtain a sampling of businesses with 1-10 employees, 11-25, 25-100, 101-500, and those employing over 500 individuals. In addition, some of the businesses were not chosen randomly, but selected due to the researcher's prior knowledge that they employed a certain number of individuals.

Although the businesses surveyed were categorized by size based on number of employees, the following graphs report the average percentage for all businesses responding. Because each business category size had a different number of respondents, the average was obtained by adding all responses for a particular answer, and then dividing that total by the total number of businesses surveyed.

Surveys and interviews with establishments collecting and selling used equipment, and those selling new equipment were conducted with for-profit and non-profit businesses, programs and municipalities throughout the state of Missouri. Some of the participants were specifically selected by the researcher, due to their involvement with electronics, while others were chosen randomly within selected geographic areas.

E. Measurements

All questions pertaining to the quantity of equipment in use, discarded, recycled, etc., were measured by number of units, and later converted to pounds and/or tons if required. The following average weight measurements were used: 1) a complete computer system at 67 pounds; 2) a monitor at 35 pounds; 3) the average peripheral at 25 pounds; 4) a television at 90 pounds.

Reported weights were determined by averaging the weight for a specific item as reported by other studies with the findings of weights reported in computer catalogs. For example, the National Safety Council (NSC) in its 1999 report measured each television at 50 pounds. Collection events in other parts of the country report an abundance of older televisions collected weighing as much as 100 pounds. The new mid-size televisions weigh between 60-114 pounds. In consideration of all weights for televisions, 90 pounds was selected for this study.

In the same study, NSC reports complete computer systems, including the monitor at a total of 60 pounds, and monitors alone at 30 pounds. Based on the weights reported in recent new computer catalogs, and most likely due to the increase in size of monitors, 67 pounds was selected for complete systems and 35 pounds for just the monitor. To determine the average weight to use for peripherals, ten different types of peripherals, including ink jet printers, laser printers, scanners, and all in one machines, were weighed with an averaged weight of 25 pounds.

F. Estimating What Will Happen to the Obsolete Targeted Electronics in Missouri

The National Safety Council's report included data pertaining to both obsolete computer electronics and obsolete computer electronics "not recycled". The assumption NSC then made was that those electronics not reported as recycled were either in storage, thrown away, or simply not accounted for.

This study applies Missouri survey results and adds an additional set of interesting assumptions to the quantities of potential computer related electronics requiring management. Two separate but related questions were asked. Missouri household and business constituents were first asked to report the methods they had used in the past or plan to use for discarding and managing the targeted electronics. In a separate question, they were then asked to report the method of management they thought to be the best. Then, based on these responses, it was estimated how many obsolete electronics, from 2001-2007, will be reused or recycled, sold, given away, donated, kept or stored, traded, and thrown away.

IV. Considerations and Challenges

Planning for current and future considerations and challenges facing the industry of obsolete electronics management will facilitate the Missouri Department of Natural Resources Solid Waste Management Program's (SWMP) decisions regarding how to best use its resources to influence positive results. Whether for the purpose of evaluating a grantee's request for funding, or regulatory considerations, an independent understanding of each of the challenges, and their resulting synchronicity will be beneficial to SWMP's decision making process. Like any industry or business planning a new or evaluating an existing product or service, preparation includes a current understanding of all the factors influencing potential success. These factors include, pricing, transportation and distribution, consumer behavior, trends, marketing, current and future end-markets, and the relationships with stakeholders and related industries.

As the state of Missouri continues to develop strategies for the best use of its' resources to manage targeted obsolete electronics, consideration of these topics will be helpful:

A. Stakeholder Involvement:
   Past, current and future decisions being made regarding the management of obsolete electronics in the state of Missouri are influenced by a combination of environmental, economical, social and philosophical interests. In the early stages of understanding the industry of obsolete electronics, identifying the major stakeholders and providing an opportunity for on-going dialogue between them is crucial. During this phase, it will also be helpful to identify a "gatekeeper" responsible for acquiring and disseminating information pertinent to the topic. In the future, the gatekeeper position could evolve into the definitive information source for consumers, businesses, and governments, and share the most current knowledge of the industry and management solutions. The involvement of all stakeholders, and establishing an ongoing forum for both discussion and sharing of information sets a precedent for the merging of all interest groups, influencing market development and successful programming.

B. The Stakeholder Dialogue:
   Concerned stakeholders involved in the process bring to the table a sometimes similar, and sometimes divergent set of criteria to evaluate the best management strategies for obsolete electronics. It is the hope of the researcher that the major stakeholders charged with the task of designing, implementing and funding obsolete electronics management solutions balance their individual needs with a practical consideration of the entire process and what is best on a global level.

   This is not an easy problem to solve, nor is there only one stakeholder to be held accountable. The process that moves the stakeholder group

forward should allow for a certain amount of posturing, protection of turf, and useful explanation of each stakeholders limitations. Hopefully though, the dialogue will move past this stage with the understanding individual interests are evaluated against a set of criteria clearly stated in an "obsolete electronics industry" mission statement.

C. Mission Statement:
If looking at the management of obsolete electronics as an industry or as a start-up business, defining the product or services the enterprise will offer (and how it is offered) becomes a priority. A mission statement is the first step in setting standards and criteria for measuring all future considerations. A mission statement should evolve and change, based on the delivery of "more mission", and not on the needs of existing or new stakeholders.

D. Consumer Involvement:
Many factors and stakeholder interests drive and influence the industry of obsolete electronics management. In observing national, regional and local workshops and dialogues dedicated to this topic, it appears that often the consumer is referred to but not included as a stakeholder. It makes sense that at all levels consumer representation is required. Are consumers aware of the major issues at hand, especially the best ways to manage and reduce potential hazards? Will consumers be accepting of more expensive, but better environmentally designed electronics? What is the consumers' anticipated response to paying a fee to subsidize proper equipment management. Important to the development of management strategies will be the best ways to educate and market "change" to consumers. And, since original equipment manufacturers (OEM's) often state that product development and design is customer driven, what can be done to encourage consumers to drive the market with a request for more-faster-cheaper-*safer* equipment, as opposed to just more-faster-cheaper?

E. Qualifying Obsolescence:
Is obsolescence the problem, or is it obsolescence encumbered by toxic and hazardous materials? It might not be the number of electronics being manufactured and becoming obsolete that is the greatest challenge, but rather the number becoming obsolete, which are potentially dangerous, expensive to handle, and thus hamper reuse and recycling efforts. In fact, if toxicity and hazard were not part of the equation, obsolescence, which encourages entrepreneurial solutions and benefits to the community might even be encouraged. If the factors responsible for the expenses outweighing revenues can be greatly reduced or even eliminated, and if the industry of obsolete electronics management encourages economic, social and community development, wouldn't the creation of obsolete electronics be encouraged?

A common opinion expressed by OEM's is that the development of new, more innovative electronics is market driven – it is what the consumer wants. Those stakeholders most concerned with environmental issues, express a different opinion – one emphasizing that OEM's are not innocent bystanders. That at the heart of this issue, and the "one" factor that can most minimize the amounts of hazardous obsolete electronics produced in the future is a commitment to product design, which lessens or eliminates toxic materials.

F. Quantity of Obsolete Computer Electronics and Televisions:

As the obsolete electronics industry is in the early stages of coordinating legislation, regulation, end-markets, and the delicate balance of stakeholders' interest, the immensity of current and future volumes of computer electronics requiring proper management is staggering. The consumer and manufacture demand-supply relationship results in increasingly sophisticated technologies at cheaper prices. More products become obsolete quicker, causing past products to have less value sooner. The end result is a tremendous waste management issue, which for the most part falls on municipal solid waste authorities.

Numerous studies, including this one, provide estimates for the current amount of obsolete computer electronics, as well as future projected amounts, potentially entering the waste stream and requiring proper management. As cited throughout this report, Missouri's contribution of obsolete targeted electronics during the next seven years equals an estimated 15 million units, or 872 million pounds. In the year 2002, this report projects that approximately two million combined computers, peripherals, CRT-monitors and televisions will become obsolete in Missouri and require management.

G. Hazardous Content:

Volume itself is not the problem. Electronic products contain a multitude of hazardous materials, commonly called E-waste, which pose significant environmental and health hazards. It is estimated that although obsolete computer electronics make up 1%-3% of landfill content, they are responsible for 50% to 70% of the heavy metals found in landfills.

For example, each CRT monitor or television contains an average of 2.8 to 8 pounds of lead. A Silicon Valley Toxic Coalition report cites consumer electronics as constituting 40% of the lead found in landfills in California. A May 2001 report for the US Environmental Protection Agency, Region IX cites 70% of the heavy metals found in California landfills, including mercury and cadmium, (used in computer plastics), comes from electronic equipment discards. Are similar amounts or ratios to be found in Missouri landfills?

In addition:

- Computer circuit boards contain numerous heavy metals including lead (known to cause damage to the human central and peripheral nervous systems, blood system and kidneys) and cadmium (a possible human risk, particularly to the kidneys);
- Computer batteries also contain cadmium;
- Brominated flame-retardants found in plastic casings, printed circuit boards and cables, contain polybrominated diphenylethers, (a possible endocrine system disrupter and reducer of the hormone thyroxin in mice);
- Poly vinyl chloride (PVC), now mostly substituted by ABS plastics, is used to coat copper cables and plastic casings. PVC's contain highly toxic dioxins and furans, which are released when burned.
- It is estimated that 22% of the world's yearly consumption of mercury (associated with brain damage) is for the manufacturing of electrical equipment. Mercury is found in flat panel screens and printed circuit boards.

Materials used in desktop computers and the efficiency of recycling methods available in 1996 can be found in Appendix II, an excerpt from Poison PCs and Toxic TVs, a report by the Silicon Valley Toxics Coalition and Materials for the Future Foundation.

H. Factors Affecting Market Development:

There are numerous factors, including the preceding points of concern, influencing successful end-markets for the targeted materials. If successful market development is defined by the potential for activity, which results in revenues exceeding expenses, then the most important part of the equation is a commodity, which will generate activity and profits. Factors to take into account when considering market development include:

i. Missouri electronics' infrastructure is in the formative stage. Available collection and processing alternatives are insufficient. And, even if they were more available, it becomes a no-win situation because certain end-markets are either saturated or under-developed. Additionally, although state funding has been used wisely in the past for managing and marketing obsolete electronics, current legislation and regulation do not support end-markets.

ii. Regulatory uncertainty results in market uncertainty; and regulation, particularly landfill banning can drive and support market development. How the targeted electronics are viewed and regulated will affect the amounts of available

materials and the costs associated with collection and processing.

Currently, computer electronics, with the exception of some CRT's, are not banned from Missouri landfills. And, Missouri's CRT disposal regulations are often ignored. As expressed by those in the business, the uncertainty regarding CRT disposal, (*are they waste or are they commodities?),* influences availability of product and the costs for their collection and processing. How future regulation can influence the market is best illustrated by visualizing how the market will be driven if all CRT's, and possibly all computer electronics are banned from the landfill. State initiatives, as demonstrated by Massachusetts, show how a waste ban on CRT-monitors and televisions can increase the collection of targeted materials and provide recycling and reuse enterprises with the assurance of a steady supply of "commodities", instead of "waste". Successful market develop will follow as the burden for handling these items shifts from municipal solid waste handlers to a infrastructure encouraged by entrepreneurialism, and supported by state legislation and regulation.

iii. The revenues generated from the reuse and recycling of obsolete electronics continues to drop, while associated expenses, including labor, transportation and processing in general edge higher. There are so many interrelated reasons for this. The most prevailing being how the continual introduction of newer and less expensive products quickly causes perceived obsolescence sooner.

Not too long ago, used or obsolete electronics could hold their value longer as more time passed between the introductions of new innovative products at cheaper prices. Now, each mail order catalog's new edition, (as just one example of marketing), advertises more-faster-cheaper electronics, causing current computer electronics to become obsolete quicker with less resulting value. That which was a "little obsolete" is now "very obsolete". The flooding of the market results in commodities losing their potential for a second or third (re)-user in a very short period of time, quickly eliminating a products reuse status.

An obsolete electronic is a different commodity at different times in its life cycle, requiring different management strategies and commanding different values. The highest

value, requiring the least amount of resources and presenting the least amount of risk to the environment is reuse. Although recycling is crucial in the management of these problematic materials, the recycling process itself is more expensive, yields less revenue for processors, and is potentially more harmful to the environment. An obsolete electronic that becomes waste is (usually) no longer a commodity.

Hardware incompatibility, missing parts and components, and the high cost to repair or upgrade in comparison to buying new, also contribute to the reason commodities lose their potential and/or practicality for reuse, and some, if not all of their value.

Software licensing and incompatibility are also major factors affecting the desirability and value of older electronics. Most new computers come bundled with an operating system – licensed to the original owner only! The same is true with most software accompanying peripherals, and with individual software programs. In addition, newer versions of the same operating system can cause conflict with existing software programs or peripherals - and vice versa.

The cost of reuse dramatically goes up when a reusable system is void of an operating system, and the re-user is required to purchase a new one. And, what makes this even more dysfunctional, is that the size requirements of newer operating systems, as well as other software, keeps getting larger, which often precludes their use with older systems having smaller hard drives, less RAM and speed capabilities. It is a common request by reuse organizations specializing in providing used computer systems to charities that the old, yet compatible operating system is left on the computer, and the license transferable at no cost.

Software licensing also affects the industry of obsolete electronics in another way. Businesses, especially larger establishments, when comparing the cost of upgrading current software to the cost of purchasing a new computer system with the latest OEM version, will often opt for the new system. This holds to be more true the closer a currently used system is to the end of its asset management cycle.

The high cost of software upgrading, or purchasing “software assurance” (allowing the customer to install any new release of products covered in an agreement during a specified time

period) influences the decision to replace current computer systems with new ones, resulting in even more "obsolete product" entering the market, and forcing prices down. Although lower prices can be a benefit to the consumer wanting a good used system, introducing more and more used equipment into the market place also has the effect described above, making equipment move from being a little obsolete to very obsolete quickly.

iv. Labor, transportation, and facility costs are the major expenses associated with the collecting and processing of obsolete electronics. The technical assistance and expertise required to triage, test, and prepare computer electronics for reuse is expensive. Although recycling requires less technical expertise, much of the initial sorting and separating is performed manually.

Additionally, to process and recycle large quantities of computer electronics requires expensive and specialized equipment. The costs to own or lease a facility, as well as facility maintenance, insurance and other operational expenses are budget considerations, regardless if the enterprise is a for-profit or nonprofit, focusing on reuse, recycling or both.

Transportation and disposal costs, including personnel, truck, fuel, insurance, etc., are a large part of an organizations budget, and factor in to the bottom-line value of the materials collected. Additionally, how the materials are prepared and packed for shipping can influence their value. Computer electronics received damaged or incorrectly sorted result in increased processing costs and lower revenues. Utilizing trained personnel, who understand that for the most part, they are handling commodities and not trash, along with a quick and efficient triage system should reduce these costs.

v. The following charts report the average revenues paid for a variety of computer electronic materials in the year 2000, as compared to first quarter year 2002. Then, based on a 33,300-pound load of combined electronics, parts and components, a comparison of the total revenues realized is reported. Excluding keyboards and mice, the individual prices paid for computer related electronics declined between 19% and 57%. The gross revenue generated from a 33,300-pound load declined approximately 43%, from $3,781 in the year 2000, to $2,169 first quarter year 2002.

A comparison of complete computer systems and working major peripherals is not provided because the prices don't fluctuate for these commodities. Reflecting on the "new sales" market, what changes dramatically is the computer system the consumer gets for the same amount of money. This emphasizes the importance of recovering computer electronics while they are still desirable for reuse, and keeping the equipment reusable for as long as possible.

Chart I. Comparing Year 2000 and Year 2002 Prices

	2000 Prices	2002 Prices	% Decline
Materials:			
Electronic scrap	$0.07	$0.04	43%
CPU's	$0.10	$0.06	40%
Printers	$0.05	$0.00	100%
Keyboards/Mice	$0.02	$0.00	100%+
Copiers	$0.04	$0.00	100%+
Hard drives	$0.19	$0.14	26%
Telephones	$0.14	$0.06	57%
Power Supplies	$0.04	$0.02	50%
Insulated Wire	$0.17	$0.10	41%
Mixed boards	$0.74	$0.60	19%
Low grade boards	$0.33	$0.20	39%
Medium grade boards	$0.78	$0.60	23%
High grade boards	$1.90	$1.25	34%
Super grade boards	$2.85	$2.50	12%

Chart II. Comparing Revenues Generated From 33,300 Pounds of Materials:

	2000 Prices	2002 Prices	Pounds Per Type	2000 Revenue	2002 Revenue
Electronic scrap	$0.07	$0.04	7,992	$559	$320
CPU's	$0.10	$0.06	10,656	$1,066	$639
Printers	$0.05	$0.00	9,324	$466	$0
Keyboards/Mice	$0.02	$0.00	699	$14	$0
Copiers	$0.04	$0.00	1,232	$49	$0
Hard drives	$0.19	$0.14	899	$171	$126
Telephones	$0.14	$0.06	300	$42	$18
Power Supplies	$0.04	$0.02	599	$24	$12
Insulated Wire	$0.17	$0.10	400	$68	$40
Mixed boards	$0.74	$0.60	300	$222	$180
Low grade boards	$0.33	$0.20	300	$99	$60
Medium grade boards	$0.78	$0.60	250	$195	$150
High grade boards	$1.90	$1.25	200	$380	$250
Super grade boards	$2.85	$2.50	150	$427	$375
Totals:			33,300	$3,781	$2,169

I. Importance of the Charitable Community:

The charitable community, including nonprofits, schools and congregations, can be a resource for end-markets as well as a resource for the collection, processing and distribution of the targeted materials. In considering the charitable community as an end-market or source for computer electronics, it is important to remember that a "donation" should not be a burden to the recipient. Computer electronics, so willingly perceived by donor businesses as a gift, often times become an encumbrance to the charity they are intended to assist. Too often charities are asked to accept broken and incomplete computer equipment, or hardware without suitable software applications. Organizations in Missouri, such as the Goodwill Industries in St. Louis, and The Surplus Exchange in Kansas City, are a valuable resource, serving as a link between industry and charity by collecting and distributing appropriate technology.

The charitable community can serve as a resource for the collection, processing and distribution of computer equipment, while at the same time building the assets of the constituents it serves. In the form of social-entrepreneurial enterprises, numerous organizations here in Missouri, and across the country, utilize the daily operations of a reuse and/or recycling center to promote computer literacy, and teach job and vocational skills. Again, Goodwill Industries and The Surplus Exchange are examples of how the industry of obsolete electronics can be more than just keeping stuff out the landfill.

V. Summary of National Electronics Efforts

Discussion Regarding National Initiatives

As stated earlier in this document, the state of Missouri does not exist in a vacuum. While each state and community may have the ability to initiate their own efforts around electronics management, factors outside Missouri affect those efforts. National efforts by equipment manufactures, retailers, recyclers, federal government and other established working groups, can significantly affect what will and will not work in Missouri. In addition, it is most efficient to come up with a strategy for Missouri that is compatible to and compatible with national efforts in order to maximize impacts. To follow, then, are several national efforts to be taken into consideration when developing a statewide strategy and program for Missouri.

A. Product Stewardship

Product Stewardship takes on many forms, but has become a larger part of the overall discussion of solid waste management. While different organizations may define product stewardship in their own ways, generally, the concept refers to proactively thinking about a product's impact throughout its lifecycle, from design to manufacture to product use to the fate at the end-of-life. With electronics, the product stewardship philosophy needs to be taken into consideration long before the end-of-life, and typically at the beginning of life, or during the time of purchase.

Product stewardship in the electronics discussion takes on several forms. In some instances, it means businesses and governments making revisions in their procurement standards in order to specify certain end-of-life options. For instance, an entity may choose to lease computers for their business or agency with the intent of having the leasing company or manufacturer take back the systems at the end of a specified period of time. This removes the burden of management from the buyer, and provides an automatic system for returning computers or other electronics at the end of their useful life to the agency. It does not typically take into account what happens to the returned equipment after that, however.

Product stewardship can be more complicated, however, than the example mentioned above. It could involve seeking and specifying computer and electronics systems that are more reusable, upgradeable or recyclable as a means of making certain that the items can be more easily managed at the end of it's useful life to the purchaser. It can also mean acquiring electronic equipment that has been manufactured with less toxic alloys, such as tin-bismuth, tin-copper, or tin-silver-copper solder instead of tin-lead, which would mean that it would be less toxic in manufacturing, use, and in the waste stream at the end of life. Another product stewardship initiative could be to purchase equipment that has been manufactured in the most environmentally-friendly manner compared to industry standards.

Product stewardship initiatives for electronics seem to be one of the more challenging ways of looking at electronics management, in part due to the lack of available information, industry's reluctance to comprehensively put efforts in design, production or marketing, and the difficulty in identifying the best option among all the options

available. That is, is it more important that a system can be reusable or recyclable or that it has reduced toxins, and so on. Other reasons that challenge the implementation of product stewardship initiatives is cost and lack of infrastructure to properly manage electronics equipment at the end of life.

Several state governments have taken a lead role in the issue of product stewardship, especially Minnesota and their Office of Environmental Assistance (MOEA). They have taken the lead on and initiated product stewardship programs in several areas of procurement, including carpet, paint, and electronics (primarily those that contain cathode ray tubes or CRT's). For more information, see the MOEA website on product stewardship at: http://www.moea.state.mn.us/policy/productstewardship.cfm

B. Product Stewardship Institute

There is a national non-profit organization called the Product Stewardship Institute (PSI) that is taking the lead on these types of efforts and is working on stewardship in the electronics industry. Housed at the University of Massachusetts, Lowell, the mission of the PSI is to assist state and local government agencies in establishing cooperative agreements with industry and developing other initiatives that reduce the health and environmental impacts from consumer products. The Institute seeks out active input from, and cooperates with, environmental groups, business interests, academic institutions, the federal government, and related organizations to achieve product stewardship goals. At the PSI 2000 Product Stewardship Forum sponsored by the Product Stewardship Institute, the Draft Product Stewardship Action Plan for Discarded Electronics was created and used as a starting point for discussions among government officials. Following momentum generated at the Forum, as well as efforts of individual state and regional organizations, the National Electronics Product Stewardship Initiative dialogue emerged. PSI's role is coordinating the more than 20 state agencies and several local agencies that are taking part in the dialogue.

C. National Electronics Product Stewardship Initiative (NEPSI)

The NEPSI dialogue was initiated in April 2000, and the first official meeting of the entire workgroup was held in November 2001. The stakeholder-working group includes 45 participants representing county, state and federal government agencies, original electronic equipment manufacturers (OEMs), environmental/ non-profit groups, recyclers, and electronics equipment retailers. The goal of the dialogue is to develop a written agreement that addresses issues of collection, reuse, recycling, financing, regulation, market development, procurement, and design. At present, the products being addressed in the dialogue are TVs, computer monitors, CPUs, and computer peripherals such as printers and scanners. The NEPSI dialogue is facilitated by the Center for Clean Products and Clean Technologies at the University of Tennessee.

After the initial meeting, the stakeholders have continued to meet every six to eight weeks in order to develop a roadmap for a national program to ensure the proper end-of-life management for electronics equipment. Three subcommittees were established to delve into key components of the issue: Regulatory, Infrastructure, and Financing.

In March 2002, the stakeholders agreed to two important assumptions as a means of progressing the dialog. The first assumption was that it is likely that there will need to be some sort of advanced recovery fee, either placed on the purchase of new electronic items, or some sort of fee paid by electronics manufacturers, in order to help cover the costs of end-of-life management. While it is still not clear what the base level of services might be covered with an advanced recovery fee, it is likely that the areas of consideration will include collection, transportation and processing (reuse and recycling). Ultimately, an advanced recovery fee would likely be have to be low enough as to not discourage the purchase of products, while attempt to cover basic costs for a management infrastructure.

The second agreed upon assumption is that a legislative action may be required in order to implement a national fee. Legislative action would ensure that all manufacturers participated in a national program equally so that there would be no "free riders" to the program. That is, no company could be generating electronics that would have to be managed at the end-of-life through a national program without contributing to the funding of the program. This would put all manufacturers on a level playing field. It is not clear at this point if there will be any consideration of legislative action beyond that of a national advanced recovery fee.

A representative from the State of Missouri, Jim Hull, has been participating in the NEPSI process and providing feedback in terms of how decisions will affect state governments' ability to implement electronics recovery programs. Hull has left the Missouri Department of Natural Resources and it is expected that John Balkenbush will take his place as the NEPSI Stakeholder representative. Missouri's participation in the process as a major stakeholder increases the likelihood that Missouri's policy, regulation, funding, and education strategies can take into account the national dialog and resulting decisions.

The NEPSI dialog is expected to continue until September 2002 at which point the goal would e to have some sort of agreement among all stakeholders as to the future direction of any national funding mechanism, legislative recommendations, established base level of service and other aspects of a national program. For more information on the national electronics dialogue, go to www.nepsi.org.

D. Electronic Products Recovery and Recycling (EPR2) Project, *A project of the National Safety Council's Environmental Health Center.*

The EPR2 Project promotes environmentally safe, responsible, and cost-effective management of electronic equipment that has reached the end of its useful life or no longer meets the needs of its original owners. The project was developed to help identify and prioritize ways to overcome market, economic, regulatory, administrative, and institutional barriers to effective management of electronic equipment throughout its life cycle.

In 1998, the National Safety Council published *Electronic Product Recovery and Recycling Baseline Report: Recycling of Selected Electronic Products in the United*

States, which documents the results of the first large-scale survey and analysis of end-of-life electronic product recycling and reuse in the United States. The research used data from 123 firms, including recyclers, third-party organizations that accept equipment for refurbishment and subsequent resale or donation, original equipment manufacturers (OEMs), and large corporate users of electronic equipment. The study shows that approximately 20.6 million personal computers became obsolete in the United States in 1998. Of that number, only 11 percent—about 2.3 million units—were recycled. The 47-page study includes many other findings including shipment, recycling, and obsolescence figures for eight different product categories.

While the accuracy of the numbers have been debated, the study continues to include the most comprehensive statistics available today, and still utilized frequently to demonstrate the potential for obsolete electronics flooding the waste stream in the coming years.

National Safety Council also continues to sponsor an annual conference to bring together all those involved in the electronics management arena to talk about latest innovations and discussion solutions to the electronics waste challenges.

E. Environmental Protection Agency Regulatory Status

One of the most difficult issues for states and communities has been the lack of a comprehensive regulation surrounding electronics management. This also creates problems for service providers working to collect, transport, reuse, recycle, export or dispose of electronics scrap. While some communities, and several states (such as Minnesota and Massachusetts) have banned Cathode Ray Tubes (CRTs) from landfills and incinerators, most have not. However, since it is clear that electronics equipment and especially that equipment which contains CRTs, such as computer monitors and televisions, contains hazardous components, there has been more public pressure to keep these materials out of the municipal waste stream. As a result, the Environmental Protection Agency will be publishing a rule in the Federal Register sometime in the Spring of 2002 for CRTs. The new CRT rule will be open for public comment and should be finalized approximately one year from the time of original publication in the Federal Register.

The new CRT rule will propose to provide a new Universal Waste Rule for CRTs. The Universal Waste Rule was developed to encourage recycling of certain household items that, though hazardous in their material composition, could be easily diverted from the household waste stream to recycling. The goal of the rule is to help relieve business entities wanting to get involved in the recycling of an item from the burden of becoming a hazardous waste generator because they were taking in and handling large quantities of the material. For instance, fluorescent tubes were one item that fell under this rule because the technology was present to easily recycle the glass, the mercury (from the ballast), and the metals from a fluorescent tube with minimal risk to public health and the environment. It was deemed that properly recycling the material was preferable to disposing the entire item as a hazardous waste under Subtitle C of the Resource Conservation Recovery Act. The Universal Waste Rule streamlines the requirements in

handling and labeling of selected materials that would otherwise fall under the handling and labeling requirements of Subtitle C (hazardous waste).

The proposed CRT Rule states that those that generate CRTs for potential reuse or repair will fall under the Universal Waste Rule, and have fewer labeling and handling requirements. This rule is designed specifically to give charities and others the ability to accept still-usable CRTs without risk of being labeled as a hazardous waste generator. If the CRT is being sent to recycling, the handling and labeling requirements are more detailed. And, any CRTs sent for disposal by incinerator or landfilling are still subject to full Subtitle C requirements.

With recent awareness of export concerns, it is also likely that any final rule will include some language that covers the regulation of CRTs destined for export.

Besides the proposed CRT Rule, there is no other current pending regulatory action planned by EPA. However, EPA has been working with NEPSI and others on encouraging voluntary standards for reuse and recycling. Once standards are finalized, there will be a tool for local and state governments, businesses, or any major generator of electronics scrap, to utilize for more responsible handling of materials through contracts and specifications.

F. <u>Export Issues and Concerns</u>

Among solid waste industry professionals, there has long been the debate about the appropriateness of export as a means of managing electronics at the end-of-life. The primary concern has been the notion of shifting the burden of ultimate waste management to poorer third world countries, and the inability of tracking what happens to the materials once it leaves the domestic borders. However, many solid waste managers and asset recovery managers have relied on export, especially of computer monitors, as a means of keeping the costs of electronics management reasonable. It is estimated that currently 50 - 80% of all electronic scrap is sent overseas, in part because it is less expensive than demanufacturing and domestic management. Though there are legitimate export options, it is difficult to verify which companies or organizations overseas are properly managing electronics in a manner safe to public health and the environment. There are also legitimate markets for electronics components salvaged from domestic demanufacturing operations to markets overseas, but, again, the tracking of this material once exported is difficult. Finding alternatives to avoid export will likely increase the cost of management, and, many fear, it will increase cost beyond what is economically feasible. As market development and technological advancements evolve domestically, there should be less dependence on export in the future. In the meantime, it is likely that guidance will be provided by EPA or other national organization to those involved in electronics management that encourages consideration of an environmental management system (EMS). To avoid "bad" export practices, the EMS could suggest acceptable industry criteria and verification procedures to follow. To avoid supporting "bad" export practices,

G. Basil Action Network/Silicon Valley Toxics Coalition Report on Export

In February 2002, the Basil Action Network (BAN) and the Silicon Valley Toxics Coalition (SVTC) released a report revealing that huge quantities of electronic waste are being exported to China, Pakistan, and India where they are processed in operations that are harmful to human health and the environment.

The report depicted economically depressed villages where migrant workers are employed to break apart and process obsolete computers, imported primarily from North America. The report highlighted men, women and children performing open burning of plastics and wires, riverbank acid activities to extract gold, melting and burning of toxic soldered circuit boards, and the cracking and dumping of toxic lead laden cathode-ray tubes. Tons of electronic scrap was documented in open fields, along rivers, and dumped in irrigation canals.

The report received a great deal of national and local press coverage, and brought a little known issue to light. It has become clear that the United States has simply shifted the burden of our solid and hazardous waste problems to developing countries. As a result, many businesses, government agencies, and individuals have a higher awareness of the obsolete electronics management challenges than before, and are beginning to question their solid waste professionals and electronics management service providers on the fate of their equipment once it leaves the generator's facility. This awareness has also resulted in increased pressure on manufacturers of electronic products to help provide domestic solutions for end-of-life management of the products they are making. There will be less tolerance for this practice in the future.

BAN is a global network of activists working for global environmental justice and against trade of toxic wastes, toxic technologies and toxic products (www.ban.org).
SVTC is a 20-year community based coalition that advocates for cleaner production, and sustainable occupational and environmental health practices within the electronics industry (www.svtc.org). A copy of the full report is available at both organizations websites.

H. Prison Labor Issues and Concerns

The practice of working with prison labor to demanufacture or dismantle electronics equipment is becoming increasing popular, not only with a federal government program called Unicor, but many state are currently engaged or considering getting in the business of electronics recycling as part of their prison labor programs. Using prison labor equates to low-cost labor, and therefore a means of reducing the cost of electronics management. The issue of prison labor, however, is becoming increasing more controversial for the following reasons: inmates potential exposure to hazardous materials found in electronics they are handling; inmates making below market wages; and for-profit recyclers having to compete with government subsidized programming which creates an unfair marketplace. Unicor representatives insist that recycling labor is a step above other jobs that prisoners could have. The Silicon Valley Toxics Coalition and other groups have come out publicly opposing programs that rely on prison labor.

As a result, it has also become a factor within the NEPSI dialog in terms of what would be acceptable under any national electronics collection system.

I. Industry Lead Efforts

i. **International Symposium on Electronics and the Environment Electronics Recycling SUMMIT®.** Annually, the Computer Society Technical Committee on Electronics and the Environment holds a four-day series of events co-sponsored by the International Association of Electronics Recyclers/IAER. This meeting is an opportunity to bring together all of the segments of the electronics industry to address critical technical and business issues concerning the industry and its impact on the environment.

ii. **International Association of Electronics Recyclers** - IAER

The mission of the International Association of Electronics Recyclers is to provide a vehicle to serve the interests and needs of electronics recyclers and related organizations. This industry trade association deals with all phases of activity associated with the recycling and reuse of electronics products, parts, and materials. The IAER was formed to represent and serve the interests of the electronics recycling industry as a key element in the development of an effective and efficient infrastructure for managing the life cycle of electronics products. A group of leadership organizations, representing a cross section of the industry sectors, such as Aarwin, Inc., Envirocycle, IBM Corporation, United Recycling Industries, Waste Management Recycling Products, Inc., and Xerox Corporation became founders who assisted in the organization, development and direction of the association.

One area, in particular, that IAER has deemed important to the future of the industry, is the support and promotion of high standards of environmental quality and regulatory compliance. As a result, the IAER has established a formal process to certify electronics recyclers. This activity supports and promotes high standards of environmental quality and regulatory compliance as well as high quality business practices in the electronics recycling industry.

Companies seeking certification must meet the criteria of the IAER Certification Standard as a result of a formal, objective certification process. The IAER Certification Program is also intended to help electronics management companies improve their management systems and gain recognition for high quality business practices. The goal is that organizations seeking to dispose of electronics equipment will be able to have confidence in selecting Certified Electronics Recyclers as their suppliers of choice, and avoid the risk of improper or illegal handling of potentially hazardous materials. The scope of IAER's Certification focuses on three primary areas: Management Systems (Environmental, Health, Safety, & Quality), Operational Capabilities, and General Business Factors. To be certified, companies must successfully complete a pre-screening process and on-site audit conducted by **Bureau**

Veritas Quality International (BVQI), an international quality and environmental standards firm.

IAER developed a certification program approximately two years ago and to date only two demanufacturers/recyclers have been certified. Some of assumed reasons for slow market acceptance include: lack of market demand for standards to date; many manufacturers focused on meeting ISO 14000 standards instead; and manufacturers have yet to see a competitive advantage compared to the effort of certification. In addition, smaller recyclers may have a difficult time getting certified under the standards. As issues, such as inappropriate export and illegal dumping come to the forefront, the need for a certification process may be considered a more important issue for those seeking services in the future.

iii. Electronics Industries Alliance - EIA

The Electronics Industries Association (EIA) is a national trade organization that includes the full spectrum of U.S. manufacturers, representing more than 80% of the $550 billion electronics industry. The Alliance is a partnership of electronic and high tech associations and companies whose mission is promoting the market development and competitiveness of the U.S. high tech industry through domestic and international policy efforts. EIA, headquartered in Arlington, Virginia, is comprised of more than 2,300 member companies whose products and services range from the smallest electronic components to the most complex systems used by defense, space and industry, including the full range of consumer electronic products. EIA is an alliance of six electronic and high tech associations committed to shared knowledge and shared influence. Each preserves its unique identity while uniting in common cause under EIA. Through proactive advocacy in the legislative and regulatory arenas, EIA provides a voice for members to address the challenges of international competitiveness. In 2001, EIA determined four legislative priority areas to address: Broadband, Environment, Information Security and International Trade.

EIA issued a press release to counter the BAN report claims. In this release, they stated: "[EIA has] taken the lead to ensure that environmentally sound recycling is a cornerstone of any electronics recycling program. EIA and several manufacturers have initiated a one-year electronics recycling grant program to gather data about what kind of collection model will be the most cost-effective and efficient in the U.S. In this program, all recycling must be in compliance with all applicable environmental, health, and safety regulations. In addition, we are actively seeking to educate consumers as to the importance of properly managing electronics at the end of their life."

EIA is also taking an active role in the NEPSI process to represent the interestsof the electronics manufacturers.

J. National Private Sector Efforts -

i. ***Waste Management's Recycle America***

Waste Management, Inc. and Recycle America is part of an international waste and recycling service provider. WMI and Recycle America's electronic recycling group is the first integrated solid waste management company to focus on the recovery of electronic materials. Since 1999, Recycle America, through its eCycling services, has strategically opened a network of electronic recovery facilities across the country that sort and recycle more than 60 million pounds of electronic material per year. In this effort, WMI and Recycle America are creating a niche within the existing larger waste hauling industry. WMI develops customized, convenient and environmentally responsible programs for small and large businesses and local and state governments. They attribute success in electronic waste recovery to: reuse of products and components; "end of life" processing; destruction of proprietary materials; collection event management; facility and transportation logistics; and commodity and materials marketing.

Recycle America was a leading participant in the State of Minnesota (Minnesota Office of Environmental Assessment) "Plug Into Recycling" demonstration project, widely recognized as the largest e-scrap recycling effort in the United States to date. Recycle America was responsible for collecting and processing over 700 tons of material from 9 regions of Minnesota over a three-month period in 1999.

Waste Management is actively pursuing partnerships with both public and private sector entities to build a national and sustainable infrastructure for electronics recycling. A recent example of such a partnership was their recycling work for Best Buy Company's retail recycling project, a series of two-day collection events in their store parking lots.

K. Electronics Retailer Efforts

i. ***Best Buy***

In April 2001, national electronics retailer Best Buy, announced plans to rollout a program to allow consumers to recycle old electronic items at Best Buy stores. This marked the first time that a consumer electronics retailer had committed to providing its customers with electronics recycling opportunities nationally. Best Buy completed Phase One at the end of 2001, and is now engaged in Phase Two, with more collection events planned for 2002. Best Buy worked with Waste Management and Recycle America in each event to manage the materials collected. In eight (8) of the ten (10) events held in 2001, the events were coordinated with non-profit reuse organizations that were able to triage materials at the point of collection and redistribute still usable units for local programs. Best Buy policy prohibits the reuse of CRTs and requires that all CRTs be sent directly to recycling. The company representative states that this policy is

in place to ensure that non-profits do not end up with the cost of disposal of a non-working CRT.

ii. **Staples**

In February 2002, Staples Stores nationally announced that they would sponsor a two-day computer take-back program in all 1400 of their office supplies superstores. The announcement stated that individuals and businesses could bring in their old computer equipment, including monitors and hard drives for no charge. People who brought in old computer equipment to Staples during the event would receive a $100 savings on a new, or $20 off a purchase of $100 or more for other Staples products purchased during those two days. Through a partnership with Gifts in Kind International, the computers were to be refurbished and given to children's organizations in communities across the country. Computers that were unable to be rebuilt "would be recycled responsibly to generate reusable materials.

Based on media releases from Staples, solid waste managers, universities and schools, government agencies and others promoted the events throughout the country. In advance of the event, many solid waste managers attempted to verify and better understand the program in order to more accurately promote the event. In many cases, this only created more confusion, as not all store managers seemed to be aware of the program or how it would work. In some instances, only complete computer systems would be accepted, while in others, computer components were taken. In some cases, computers were only taken back if the person was purchasing a new computer. In addition, those who were aware did not seem to understand the real potential for reuse from these residentially generated, older units.

Computers collected at retail stores were packed and shipped to Staples' regional distribution centers. Then Gifts In Kind who partnered with another non-profit for refurbishment and distribution picked up materials. No numbers have been issued regarding the amount of material that was ultimately reused and recycled. It is suspected, however, that, in the end, this was a costly venture for the national retail company. It might, however, serve as a good model for handling electronics through reverse logistics methods in the future.

L. Manufacturer's Efforts

i. ***Hewlett Packard and IBM*** both operate a reuse/recycling facility for their equipment. HP instituted an e-waste recycling program in May 2001. Since then, consumers can list their computers on a Web site and HP will pick up the computers and send them to a recycling center for a fee of $13 to $34 each.

Sony initiated a take back of any equipment for $30 intended to cover shipping costs.

Dell has for some time offered national leasing programs whereby they take back a computer systems after a contract period, often two years. On May 17, 2002 Dell announced a national initiative to recycle consumers' outdated notebook and desktop personal computers. It is expected that the fee-based program will be implemented in the Fall of 2002 and will accept computers from any manufacturer, not just Dell. This move occurred in large part as a result of pressure from Calvert Funds, a socially responsible investment firm, which initiated a shareholder resolution calling for Dell to take action on computer waste as well as the company's general concern for the environment. Calvert initiated similar resolutions with four other electronics manufacturers, including Hewlett Packard, Apple, IBM, and Compaq. The resolution will be considered at Dell's annual shareholder meeting on July 18, 2002 in Austin, Texas.

The computers taken back through Dell's program will be sent to Unicor, a program of the Federal Prison Industries, whereby federal inmates will demanufacture materials for recycling.

In addition to the take-back program, Dell offers an on-line service, Dell Exchange, to help people trade-up, auction, or donate their computer system.

Dell has, since 1991, offered similar services to business customers and estimates a recovery of two million computers since its inception.

ii. ***Design for the Environment****:* Design for the Environment means that original equipment manufacturers (OEMs) design a system with the environment in mind. While similar to product stewardship in some ways, this term focuses specifically on the designers of electronics equipment. While many of the electronics manufacturers are doing design changes to reduce the use of energy (primarily motivated under the Energy Star Program), few are actually making great efforts to design for end of life management by reducing toxicity, and making systems more reusable, upgradeable, or easily demanufactured or recycled.

One issue that the electronics manufacturers have addressed is making an effort to have compatible plastic components within an electronic piece of equipment. Another, but less prevalent design change has been manufacturing a system with the thought of ease of disassembly, such as screwed parts instead of glued parts. This creates fewer steps to disassembly, making recycling more efficient. While design seems to be one of the most important keys to long-term efforts on end-of-life management, today, it plays only a minor role in the discussions.

M. Summary of How National Initiatives Can Affect State Efforts

i. ***Funding programs:***

Likely, through the NEPSI dialog, there will be a funding mechanism to assist in covering the costs of local program, however the levels of funds, scope of base service, and other details are yet to be determined.

ii. ***Education:***

Increasing national awareness should trickle down to encourage more individuals, businesses and others to participate in responsible management of electronics.

iii. ***Regulation:***

If a national ban on CRT's or other electronics were instituted, it would push development of infrastructure on the local and regional levels. Since this does not seem likely at this time, states may consider this action as a means of keeping the most toxic electronic equipment out of the municipal waste stream.

iv. ***Market Development:***

Need to support existing electronics reuse and recycling infrastructure, assist them in achieving high levels of professionalism to meet national standards; to expand operations to accept more supply; and encourage new electronics reuse and recycling opportunities through standard market development channels, such as grants, loans, education, and technical assistance.

It will be most efficient to set up infrastructure on a regional basis, but this could be challenged by the difficulty in getting inter-local agreements required in order to implement government programs; however, if implemented by non-profits or private businesses, this would not be an issue.

Establishing efficient and cost-effective domestic market development opportunities will be a primary means for reducing export of materials.

v. ***Policy:***

Creating a push on electronics equipment manufacturers and retailers for shared responsibility will spread out the burden of cost and promotion as well as drive commitment, so that all the effort of electronics management programs does not fall on the states, cities, towns or local solid waste authorities as it does primarily today.

Continue to participate in the NEPSI dialog to have a strong voice in the future of the funding mechanism, infrastructure development, and regulation.

VI. Survey Findings

A. Households Consumers Using Computer Equipment.

Phone surveys with 120 household consumers, 18 years or older, were conducted utilizing infoUSA's Select Phone database. Geographic areas were targeted to represent a sampling of metropolitan, suburban and rural areas. Then, within these targeted areas, phone numbers were chosen randomly. With the exception of Question A6, which reports the number of responses regarding methods used to manage obsolete electronics, all survey responses are reported as a percentage.

Summary of Findings:

•42% of the households responding report having only one computer system in the home, while 35% do not currently own a computer. National statistics indicate that 51.5% of Midwestern households have at least one computer.

•16% of the households responding have at least one unused computer system in storage; conversely, 84% report having none in storage.

•72% of households report the age of their computers in use to be under three-years old, while only 23% report replacing an existing computer within three years. This reflects industry trends reporting a slow down in consumer's willingness to purchase new computers.

•The most common reason given for not getting rid of unused computer equipment by households is the belief that the equipment is too valuable (28%) And, 47% of the respondents believe the equipment they are not using has retained 50% of its value.

•When asked what disposal or management methods they have used in the past for obsolete computer equipment, 80 households said they have or will throw the equipment away, 48 said they would find an organization to reuse or recycle it, and 27 said they would donate the equipment to a charity.

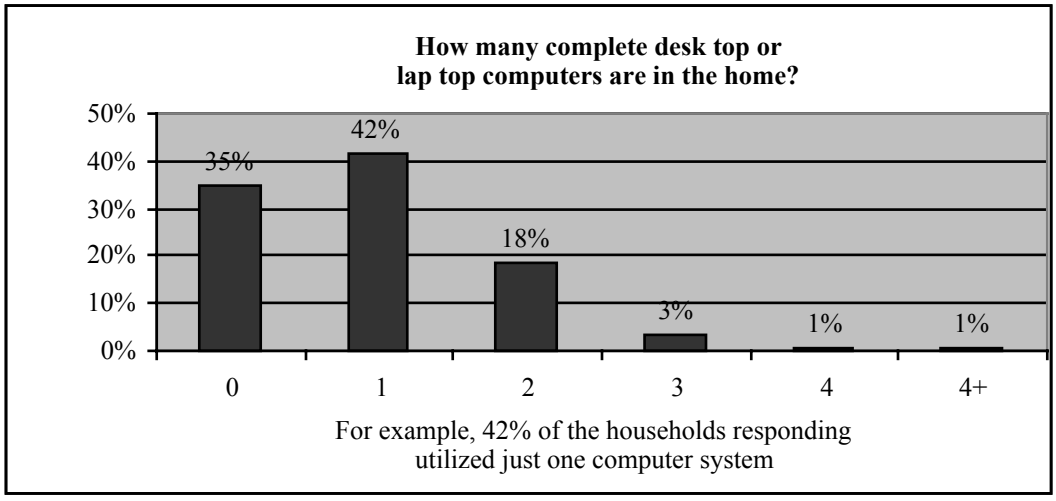
•When asked what they believed to be the preferred method for managing obsolete computer electronics, 33% stated donation, 18% reuse or recycling, and 16% preferred throwing the equipment away.

•Only 67% of the respondents acknowledge knowing that computer electronics contain toxic materials, which have the potential to pollute the environment.

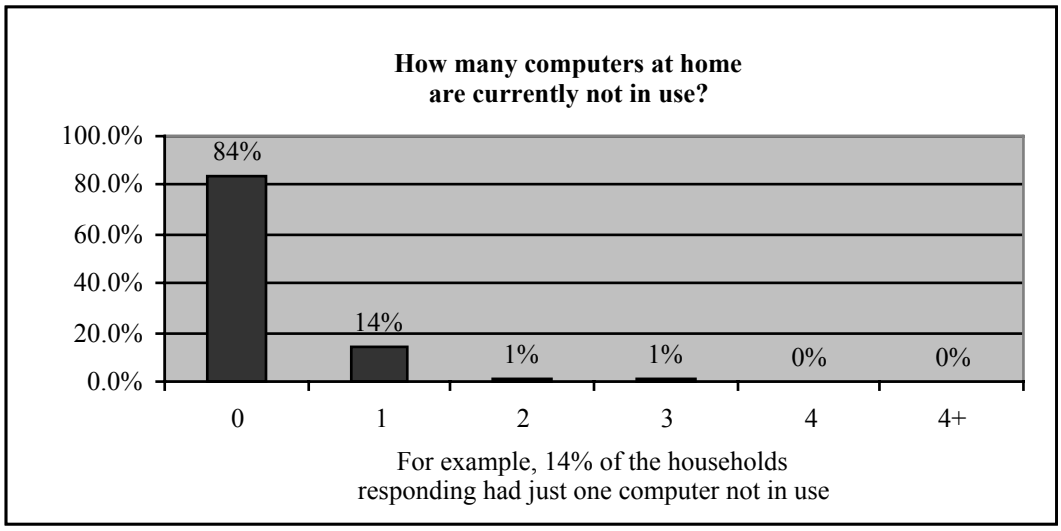
•35% of the households responding believe manufactures are solely responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment, while 40% believe it is the responsibility of manufacturers and retailers, 7% believe it is the responsibility of manufacturers and consumers, and 13% believe it is a responsibility shared by all.

Survey Questions:

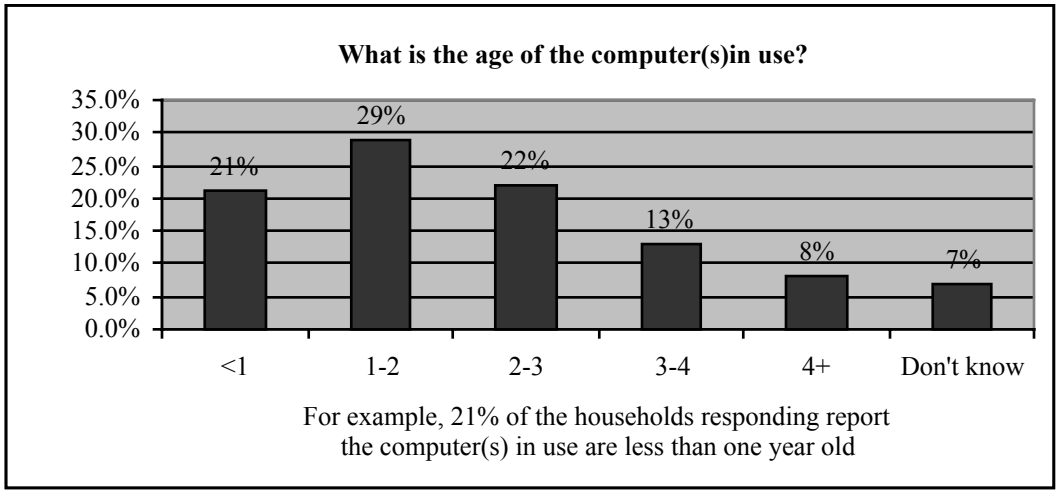
Question A1: How many complete desktop or lap top computers do you currently have in the home that are in use? Respondents were asked to account for all complete computer systems in use only. Computer systems described as "used infrequently", or owned by the household but kept off premise, were counted in this question.



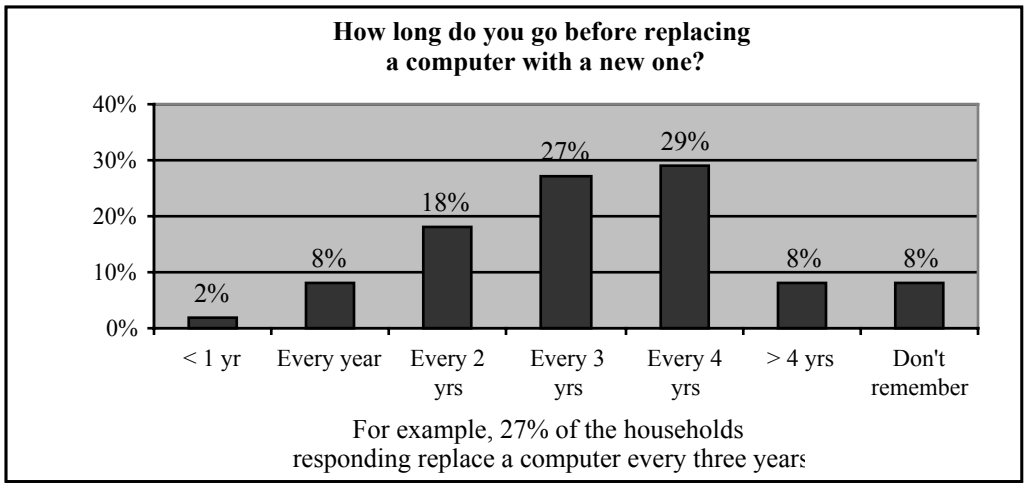
Question A2: How many computer systems currently in the home are not in use? Respondents were then asked to account for *only* the complete computer systems not currently being used, working or not. Computer systems described by the respondent as "being used only once in awhile", were considered as computers "in use" and not counted for this question. In hindsight, and for the purpose of determining the number of working computers in storage, it would have been informative to distinguish between "working computers not being used" and "*non*working computers not being used."



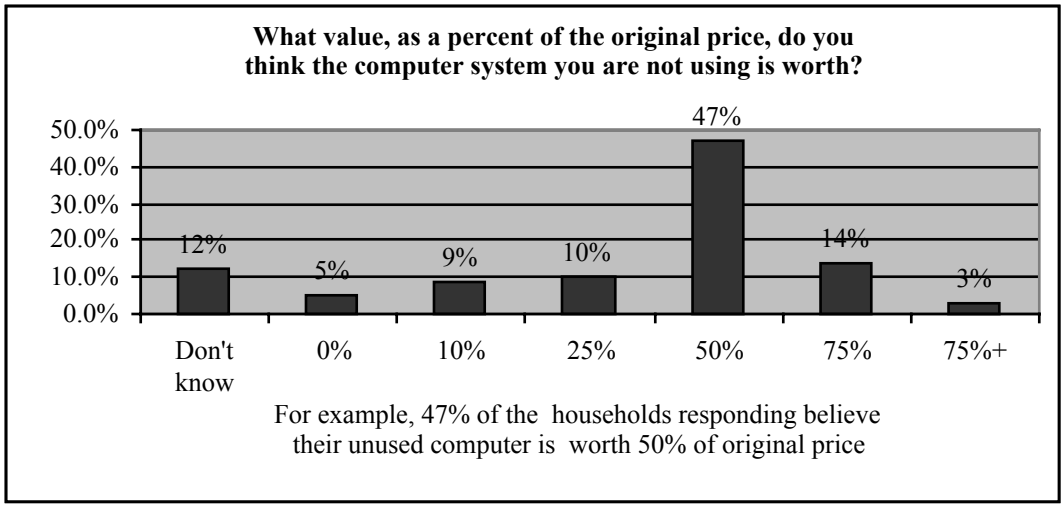
Question A3: What is the age of the computer(s) in use? Respondents were asked to report the age of all desktop and laptop computer systems at home, which were currently in use. When not sure, the researcher prompted the respondents by repeating the choice of age ranges.



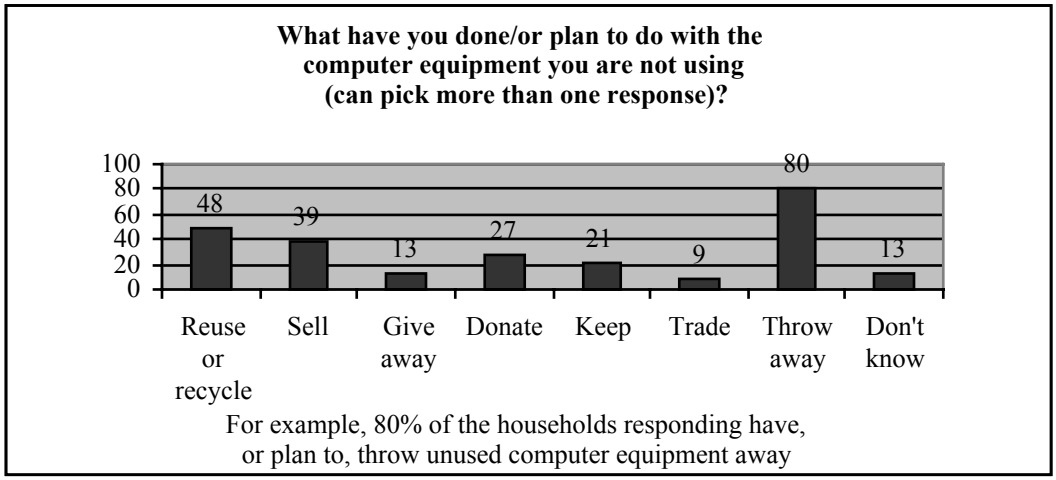
Question A4: How often do you replace an existing computer with a new one?



Question A5: What value, as a percent of the original price, do you think the computer(s) you are not using, is worth? By asking this question, the researcher wanted to determine if perceived value was a factor for households holding on to unused computers. The researcher prompted the respondents by asking, (and repeating if necessary), "Do you think the computer has no value, or is worth 10%, 25%, 50%, 75%, or more than 75% of its original value?"

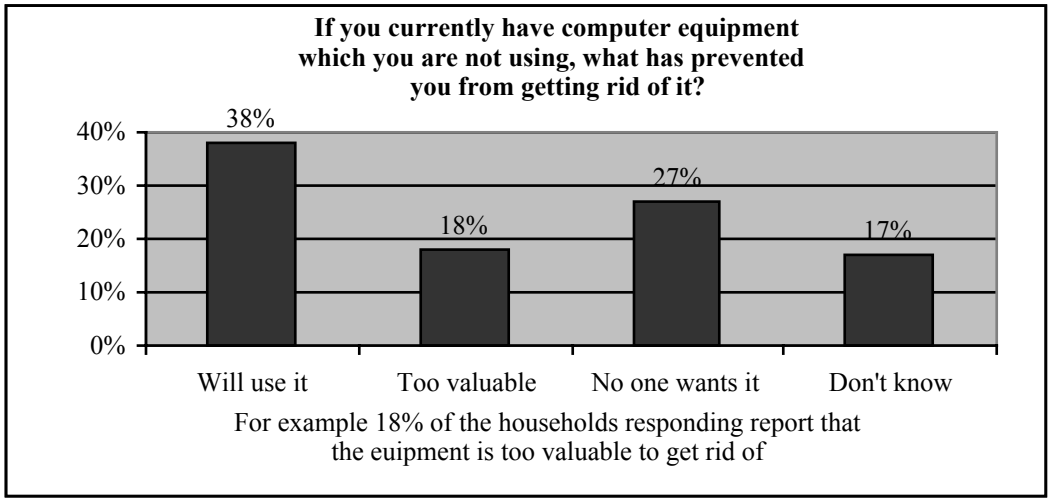


Question A6: What have you done in the past, or plan to do with computer equipment you currently are not using? The respondents were told they could also include major peripherals such as printers and scanners in their response. To determine the respondents' unsolicited opinion, the question was first asked without listing any choices. If required, the researcher then prompted the respondents by reading the list of choices. It is important to note the difference between the choices of "Give away" - which was described as giving it to anyone other than a nonprofit organization, charity, school or religious entity; and "Donate" – which was described as giving it to a nonprofit organization, charity, school or religious entity. The number of responses is greater than the number of respondents due to fact that many of the respondents reported various choices taken in the past.

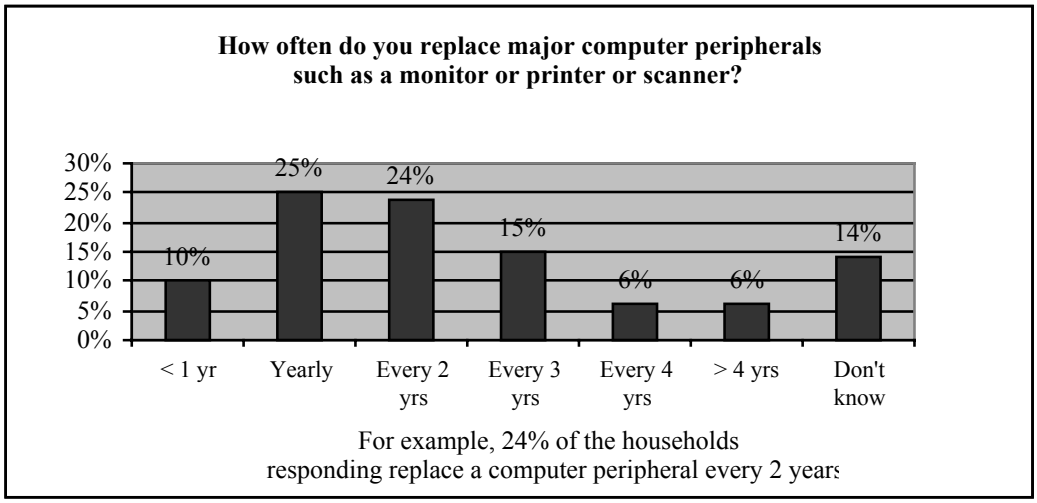


Question A7: If you currently have computer equipment, which you are not using, what has prevented you from getting rid of it? It is a common opinion that many computer electronics, although considered obsolete, or not in use, are in storage. Understanding why users hold on to equipment will help develop future

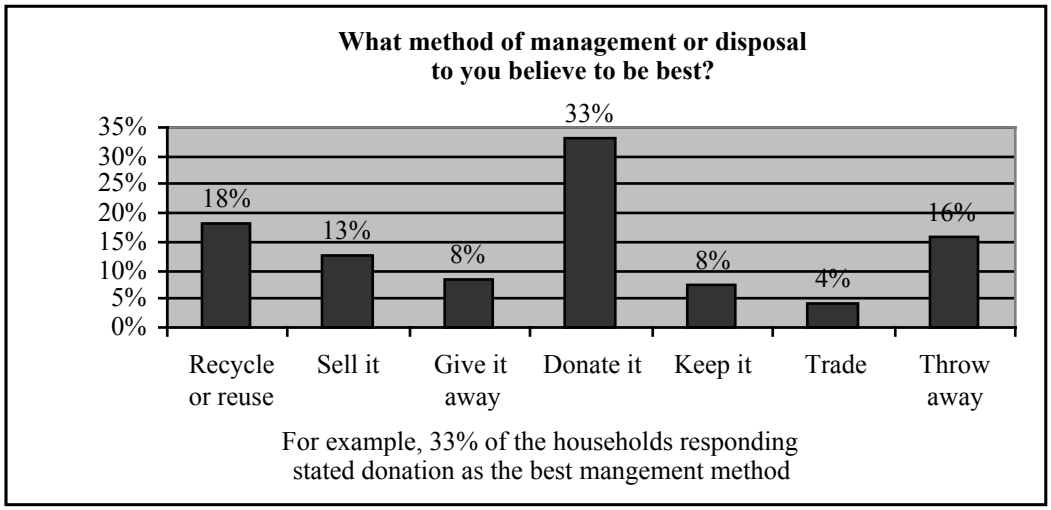
management strategies and ways to motivate people to mange equipment before it truly does become obsolete. Again, the question was first asked without prompting. If required, the researcher then asked the respondents if they believed they might use it someday, if the equipment was too valuable to consider getting rid of it at this time, or if they believed no one would want it. It is interesting to note that not one household replied by saying they wanted to get rid of equipment but didn't know how.



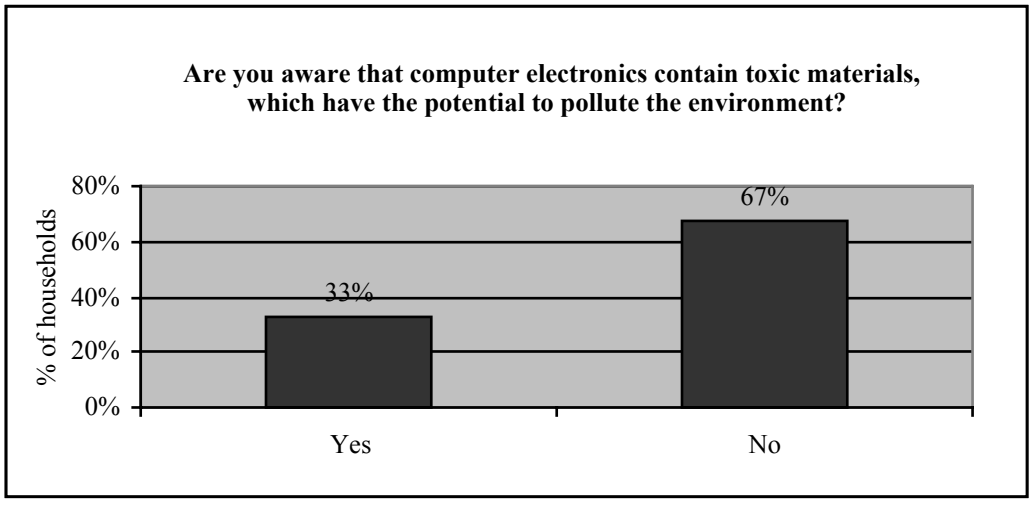
Question A8: How often do you replace major computer peripherals such as a monitor, printer or scanner? Respondents were asked to estimate how often they replaced a peripheral with a newer model. Monitors were included in this description due to industry reports of the fast growing after sales of new monitors. In hindsight, it would have been helpful to ask respondents if they replaced peripherals due to the high cost of repair in comparison to the low cost of buying a new one, or the perceived enhanced performance of a newer model.



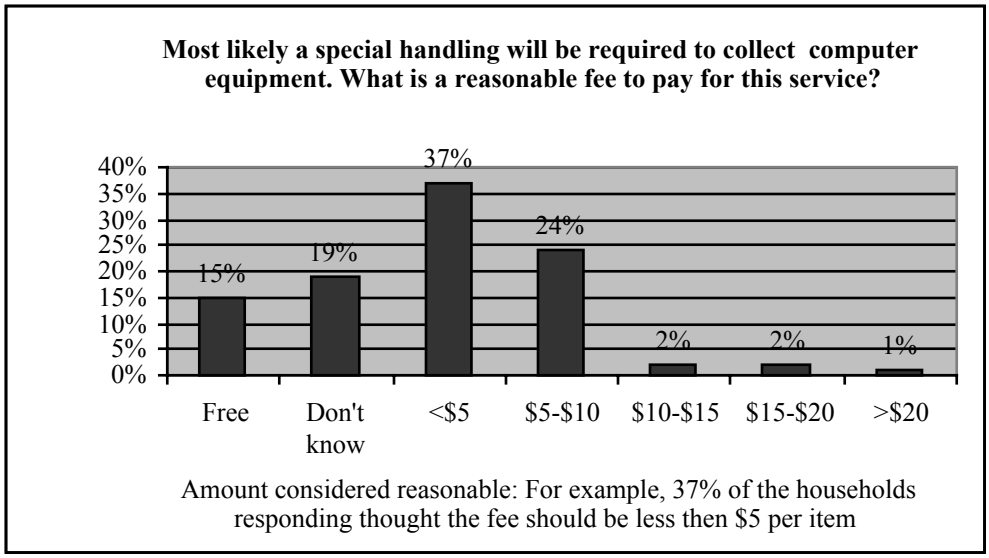
Question A9: What method of management or disposal do you believe to be best? Although asked what they had done in the past, or plan to do in the future, the researcher believed it important to have the respondents state an opinion regarding the "best" means of disposal or management. It is interesting to note that when asked what they had done in the past, the most selected method was to throw the equipment away, with donation the fourth choice. With this question, donation was by far the most popular choice, with 33% stating donation as the first choice, 18% stating recycling or reuse as their second choice, and 16% saying they would throw the equipment away.



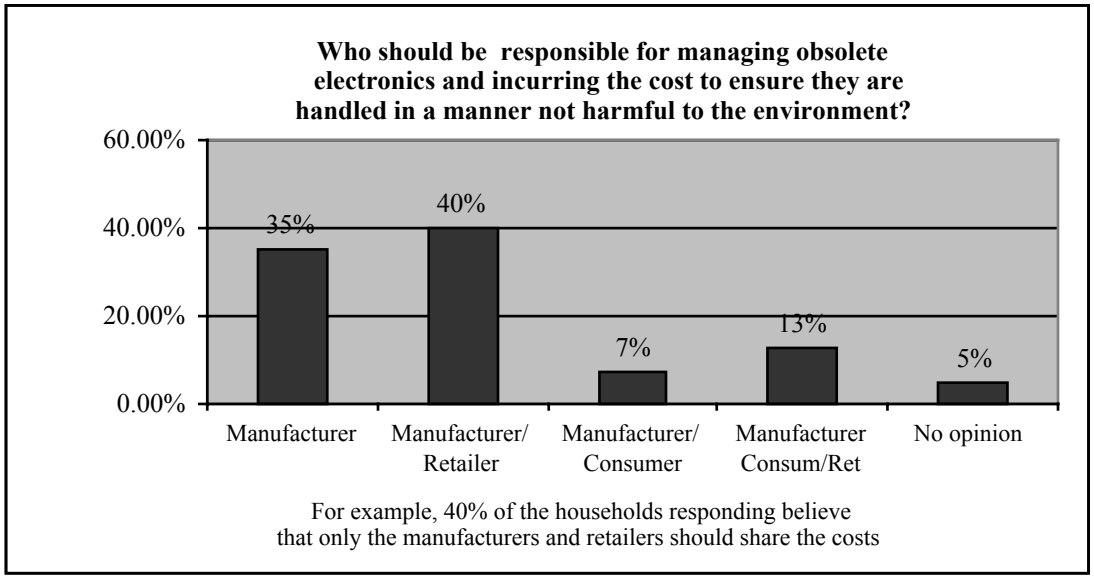
Question A10: Are you aware that computer electronics contain toxic materials, which have the potential to pollute the environment? This question was asked to determine the respondents' awareness of the impact the targeted materials may have on the environment. In hindsight it would have been interesting to then ask the respondents if now knowing this, would it affect their preferred method of disposal or management. These results reinforce the researcher's belief that any strategies developed to more effectively manage the targeted materials should include an educational component.



Question A11: Most likely a special handling fee will be required to collect computer equipment. If so, what do you consider a reasonable fee to pay for this service? It was explained to the respondents that the fee would ensure that the equipment would be handled correctly, minimizing harm to the environment.



Question A12: Who should be responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment? As is the case with all stakeholder groups except business consumers, the group responding (in this case household consumers) holds others more accountable than they hold themselves.



B. Business Users

Phone surveys with 155 business consumers were conducted utilizing infoUSA's Select Phone database and Sorkins Directory. The researcher obtained a sampling of businesses with 1-10, 11-25, 26-100, 101-500, and 500+ employees. Not all businesses were chosen randomly, as some were specifically selected due to previous knowledge of their size. With the exception of Question B6, which reports the number of responses regarding methods used to manage obsolete electronics, all survey responses are reported as a percentage. Additionally, the averages reported are for all businesses responding, regardless of size.

Summary of Findings:

•On average, 32% of the businesses surveyed currently utilize between 2-10 computers; and 50% of all computers in use are between 2-4 years old.

•54% of businesses surveyed purchase a new computer to replace an existing one every 1-3 years, while 84% do so within four years. Larger businesses are inclined to wait longer than smaller businesses before replacing computers.

•63% of the businesses responding report having computer systems currently not in use, while 89% report having various peripherals not in use. Smaller businesses are less likely to have unused computers in storage.

•64% of the businesses report storage for future use or for unspecified purposes as the most common reason for not getting rid of unused electronics, while 17% keep unused equipment because they believe the equipment is too valuable to get rid of.

•A significantly higher percentage of larger businesses have utilized reuse or recycling and donation as management methods, while conversely; the percentage of smaller businesses throwing equipment away is significantly higher.

•The most common method of obsolete electronics management reported by all businesses is to throw the equipment away, with reuse or recycling second, and donation third. But, when asked what one method they believed to be the best, 35% stated donation, 25% preferred throwing the equipment away, and 17% used reuse or recycling.

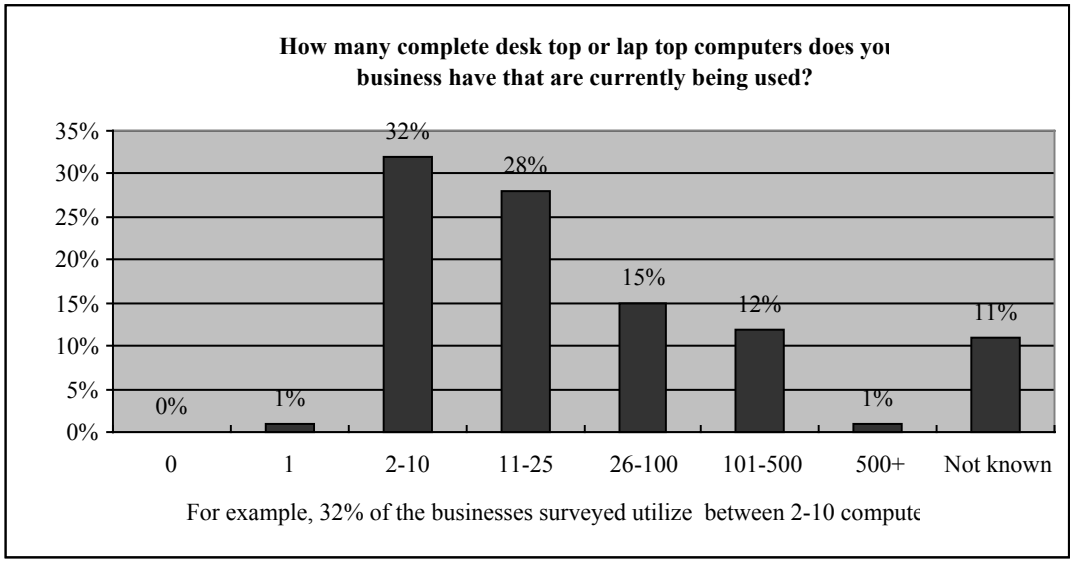
•78% of the respondents currently pay a fee to have their unused computer equipment picked up, while conversely, 21% do not. The percentage of larger businesses paying a fee for this service is higher then smaller businesses.

•Only 60% of all businesses surveyed report knowing that computer electronics contain toxic materials, which have the potential to pollute the environment. The percentage having this knowledge is significantly higher with larger businesses.

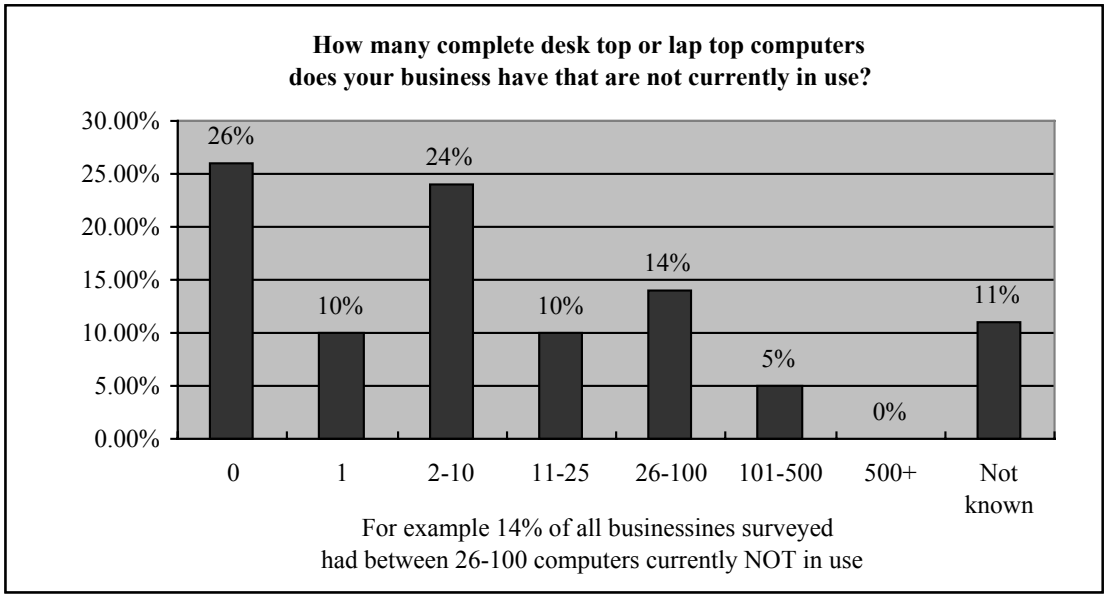
•25% of the businesses responding believe manufactures are solely responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment, while 12% believe it is the responsibility of manufacturers and retailers, 32% believe it is the responsibility of manufacturers and consumers, and 26% believe it is a responsibility shared by all.

Survey Results:

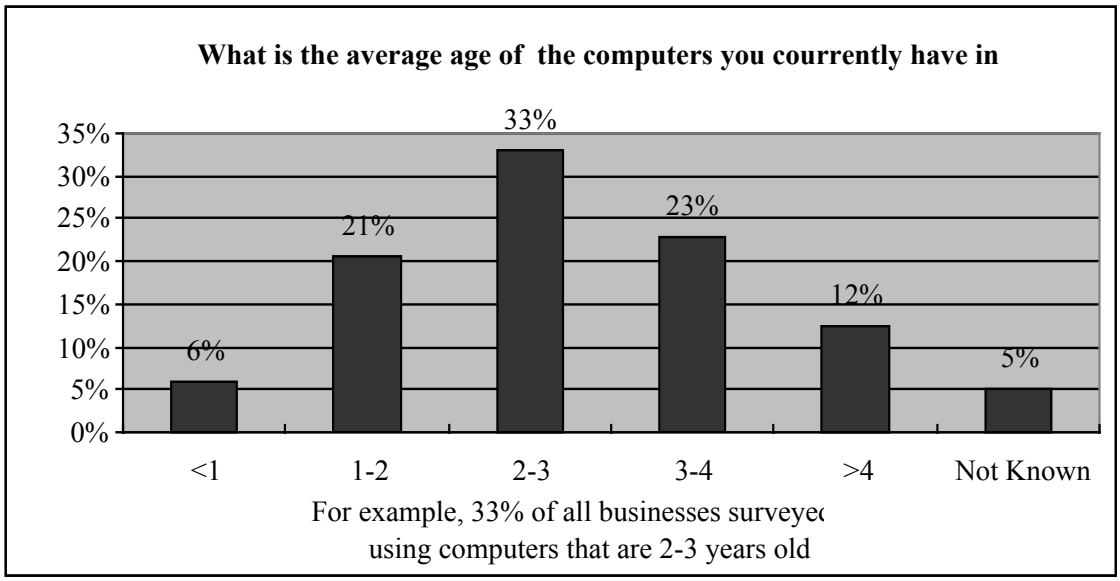
Question B1: How many complete desktop or lap top computers does your business currently have, which are in use? Businesses were asked to account for all complete computer systems - *in use only*. As often as possible, the researcher tried to interview the person responsible for asset purchasing or management. In almost all instances, the respondent was able to only report estimates, usually equating the number of computer systems to the number of employees. For example, statements such as, "We fall into the category of businesses with 26-100 employees, and about half our employees are using computers", were common. The number of computer systems utilized is most closely proportionate to the number of employees with smaller businesses surveyed. Most likely, this is due to the researcher's selection of certain larger manufacturing businesses to interview, which fall in the 101-500 and 500+ categories. In most cases, manufacturing businesses have a smaller portion of staff utilizing computers.



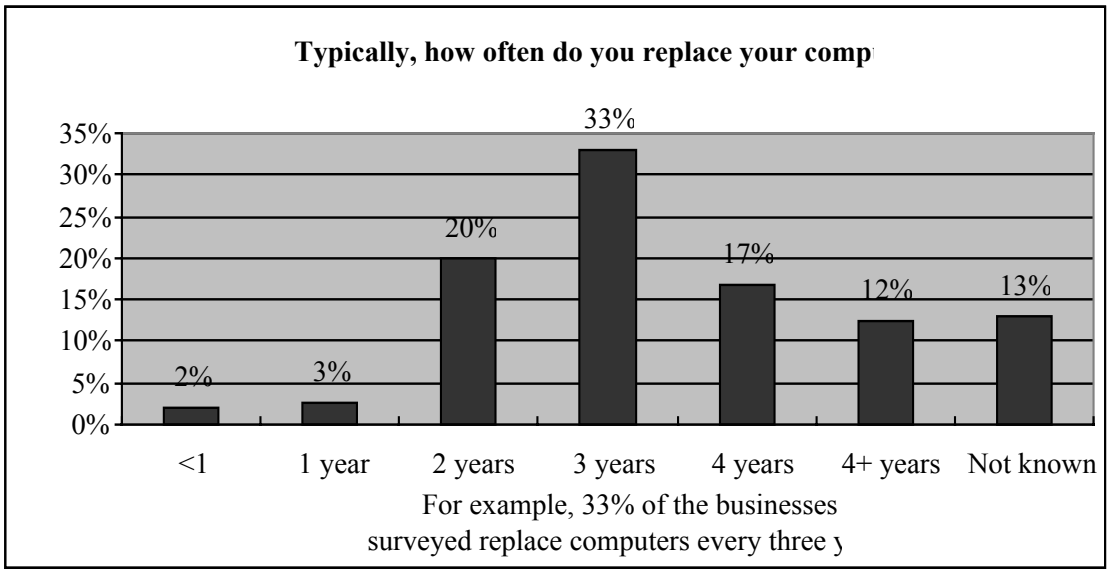
Question B2: How many complete desktop or lap top computers are currently at the business, but not in use? With this question, businesses were asked to account *only* for the complete computer systems not currently being used, working or not. It appears that the smaller the business, the less likely there are to be computers not in use. Most likely, this can be attributed to the factor of volume – that larger businesses have more equipment at any given time to manage, thus it would make sense that computers not in use would be more prevalent. It was the researcher's belief, prior to the surveys, that larger businesses would stockpile less often. It was assumed that larger businesses are more concerned with the amount of space used equipment takes up, and that these businesses were more motivated than smaller ones to find a contractor to collect the equipment on a regular basis. In hindsight, and for the purpose of determining the number of working computers that sit in storage and could otherwise be "reused" by a charity, school or another business, it would have been informative to distinguish between working computers and *non*working computers currently in storage.



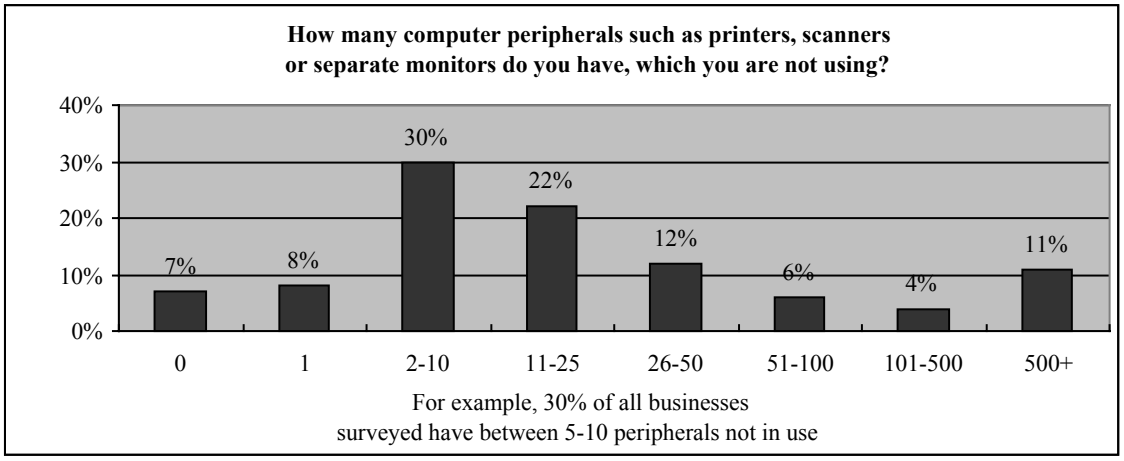
Question B3: What is the average age of all computers currently in use? Businesses were asked to report the average age of all desktop and laptop computer systems currently in use. When not sure, the researcher prompted the respondents by repeating the choice of age ranges. In reviewing the data as reported by size of business, it appears that at least 50% of all computers in use are between two and four years old.



Question B4: How often do you replace a computer system? Respondents were asked to estimate the amount of time they used a computer before replacing it with a new model. It appears that on average, 54% of all businesses replace a computer(s) every one to three years, while 83% do so within four years. Although not shown on this chart, 78% of all businesses surveyed report that they are utilizing computers longer (did not identify a specific period of time) before buying a new one. This seems to parallel national trends, which report business users holding on to a computer an additional 6-12 months before buying a new one.

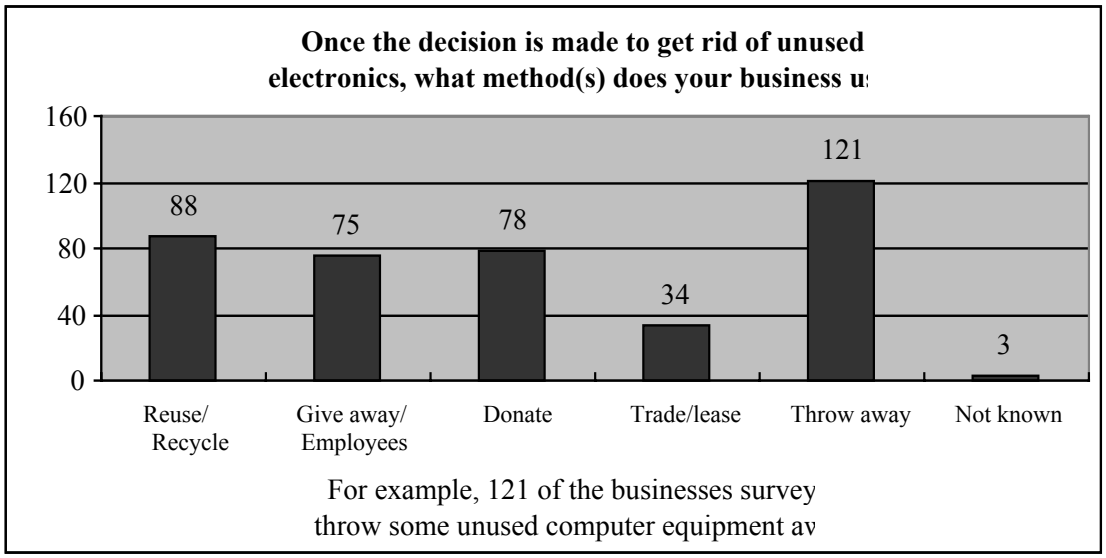


Question B5: How many peripherals such as printers and scanners are currently at the business, but not in use? Businesses were asked to account *only* for the peripherals not currently being used, working or not. The average number of unused peripherals for all businesses is higher than for unused computers. In reviewing the data as reported by size of business, it appears that larger businesses average about the same for stored computers and stored peripherals, but smaller businesses, particularly those in the 1-10 and 11-25 size ranges report a much higher number of unused peripherals than computers. The researcher believes this can be attributed to a number of factors, which parallel national trends. First of all, although computer sales have shown a 5%-10% decrease for 2001, sales of peripherals, including after market sales of new monitors, have shown an increase, ranging from 3.5% to 11%. Secondly, consumer-buying habits indicate that the low price of peripherals motivates buyers to purchase new equipment prior to their existing equipment becoming obsolete or unusable. The assumption might be made, that with smaller businesses, which are less likely to have a system in place for equipment asset management, there is less motivation to dispose of equipment no longer being used – especially if that equipment is working and has a perceived value to the owner.

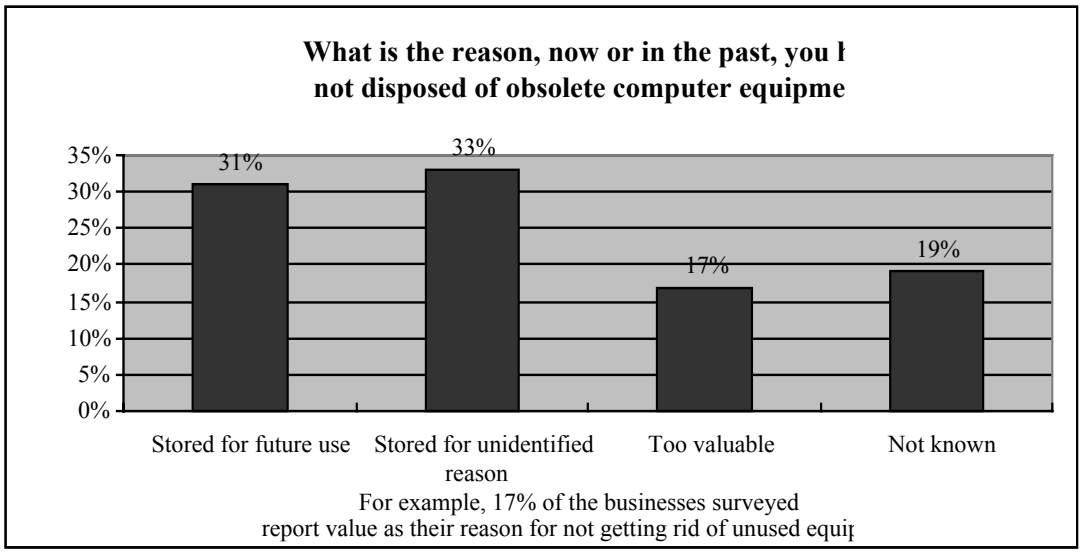


Question B6: Once the decision is made to get rid of unused electronics, what method(s) does your business typically use? Businesses were asked to report all methods utilized to dispose of or manage unused computer equipment – including peripherals. Methods reported with the most frequency are to throw the equipment away, reuse or recycle, and donation. A significantly higher percentage of larger businesses have utilized reuse or recycling and donation, while conversely, the percentage of smaller businesses throwing equipment away is significantly higher. To determine the respondents' unsolicited opinion, the question was first asked without suggesting any choices. If required, the researcher then prompted the respondents by reading the list of choices. It is important to note the differences between "Give away/employees" – which was described as giving or selling the equipment to staff, or giving the equipment to other than a nonprofit organization and "Donate" - which was described as giving

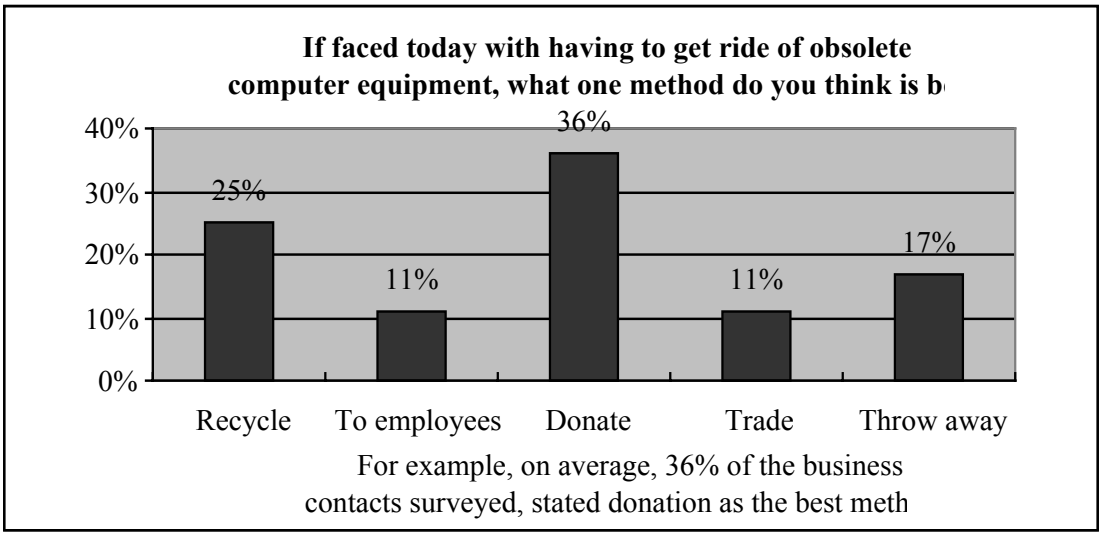
it to a nonprofit organization, charity, school or religious entity. The number of responses is greater than the number of respondents due to fact that many of the respondents report various methods for getting rid of electronics. In hindsight, it would have been helpful to ask businesses if they selected a method at a particular time because another method was not available, or unknown to them. For example, would a business, which had thrown equipment away, and opt to donate the equipment instead if they knew of this option. In addition, it would have been informative to know if they used a particular method for particular types of equipment. For example, did they throw nonworking monitors or printers away, and give working computers to staff or a school.



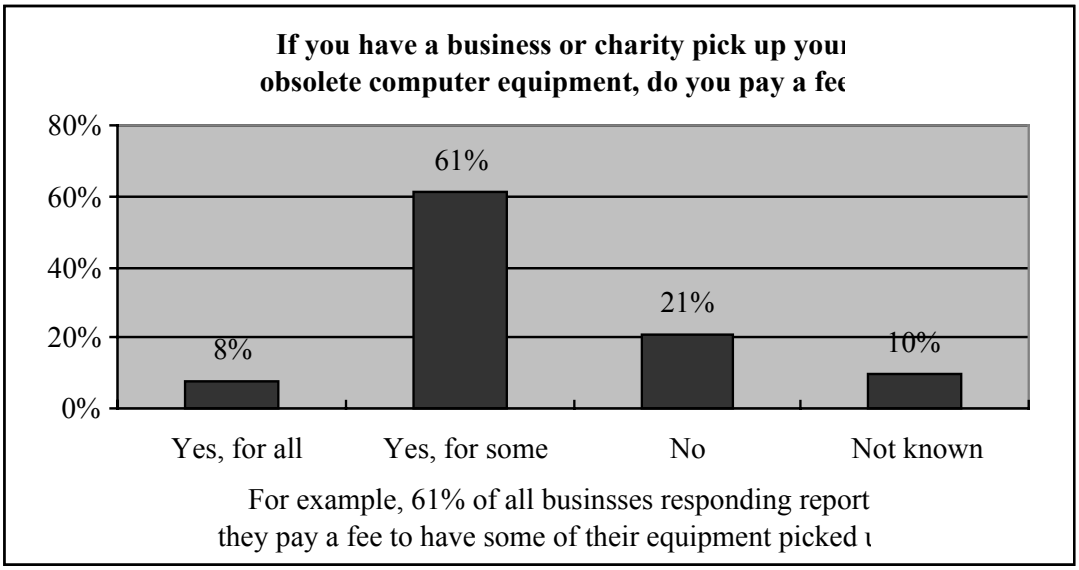
Question B7: For what reason, now or in the past, did your business decide not to get rid of computer equipment it was no longer using? Understanding why businesses hold on to computer equipment will help develop future management strategies and ways to motivate businesses to mange equipment before it truly does become obsolete. The longer computer equipment remains in storage, the older and more functionally obsolete it becomes, with less chance of finding reuse opportunities and the greater likelihood for the decision to be made to throw it away. Again, the question was asked without prompting. If required, the researcher then asked the respondents if they were storing the equipment because they might use it someday, if the equipment was too valuable to consider getting rid of it at this time, or if it was being stored for other reasons.



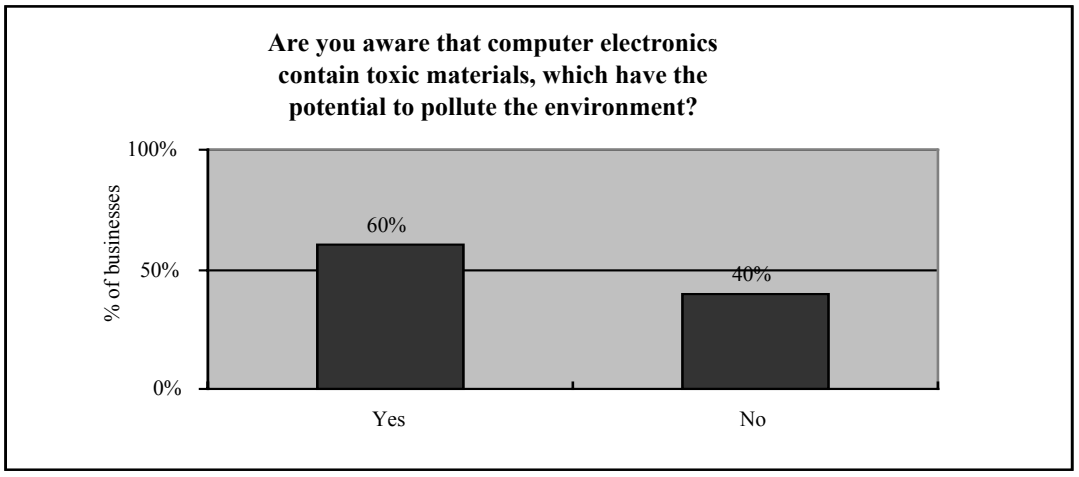
Question B8: If faced today with having to get rid of obsolete electronics, what one method do you think is best? Asked what they had done in the past, or plan to do in the future, businesses were also asked to state what one method they believed to be best. On numerous occasions, the researcher was asked by the respondent if "best" meant best for the business, or best for others or the environment. The researcher prompted the respondent by suggesting they take all factors into account. It is interesting to note that when asked what they had done in the past, the most selected method by all businesses was to throw the equipment away, with donation the second choice, and reuse or recycling the third. With this question, donation was the first choice, throwing the equipment away the second, and recycling or reuse the third. This remained consistent regardless of the size of the business.



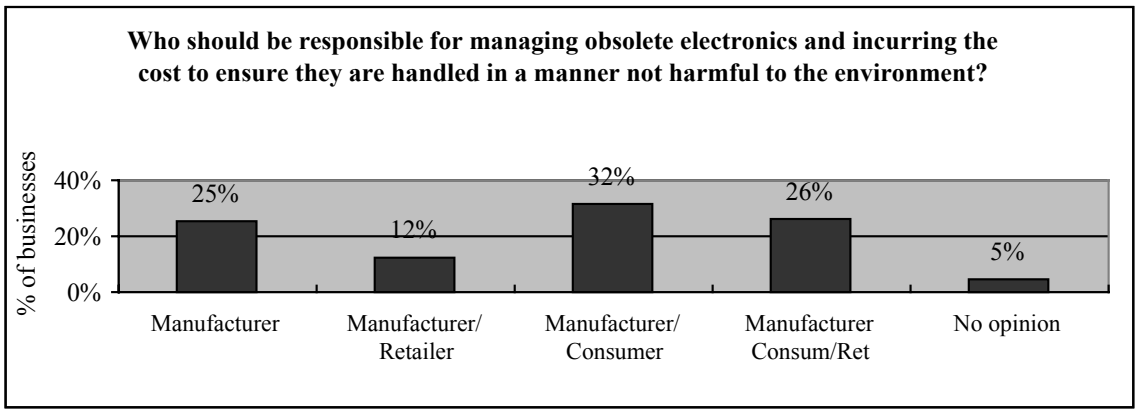
Question B9: If you have a business or charity pick up your obsolete computer equipment, do you pay a fee for this service? National trends indicate that businesses are becoming more accustomed to contracting with a for-profit business or nonprofit organization to collect their unwanted computer equipment, and paying for this service. On average, 69% of the businesses surveyed pay for some or all of their equipment to be collected, while conversely, 21% do not. The percentage of businesses paying for this service increases with the size of the business. This makes sense, as larger businesses typically have to be more concerned with asset management, are more aware of the options available, and are willing to pay a fee for this service.



Question B10: Are you aware that computer electronics contain toxic materials, which have the potential to pollute the environment? Although the majority of businesses surveyed acknowledge the potential hazards coming from computer electronics, a significant number don't. These results reinforce the researcher's belief that any strategies developed to more effectively manage the targeted materials should include an educational component.



Question B11: Who should be responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment? Business consumers are the only group surveyed that hold themselves at least equally responsible for this concern. Most likely this is due to the fact that the majority of businesses surveyed are accustomed to paying a fee to have their obsolete computer electronics handled by others.



C. Dealers Collecting and Selling Used Computer Equipment

Phone surveys were conducted with 25 dealers in the business of collecting and selling used computer equipment. Utilizing infoUSA's Select Phone database to identify dealers by Standard Industrial Code (SIC), and the researchers previous knowledge of existing dealers, a sampling of businesses was selected throughout the state of. Not all businesses were chosen randomly, as some were specifically selected due to previous knowledge of their size. With the exception of Questions C5 and C7, which report the number of responses, all survey responses are reported as a percentage. The marketing focus and products sought vary with each dealer type. There are those that market their services primarily to businesses, some that are storefront operations, marketing more to the individual customer; and there are some that do both. Additionally, some of the dealers are reuse oriented, with sales of complete units as their core business; while some are demanufacturing and recycling oriented, with sales of parts, components and recyclables as their focus; and there are those that do both. Responses are not broken down per core business type.

Summary of Findings:

•84% of the computer electronics collected by dealers comes from businesses, while conversely; only 16% are acquired from households.

•56% of the computer electronics collected by dealers is recycled; parts and components account for 32%, and 12% are sold as complete units.

•34% of the dealers will take any type of old or obsolete computer, while 66% will only take Pentiums.

•92% of the dealers surveyed charge for at least some of the computer equipment they collect or acquire, while 8% never charge for any equipment they accept.

•84% of the dealers surveyed have thrown computer electronics and their materials away, with plastics being the most identified material being thrown away, and the general category of "non-repairable" equipment being second.

•80% of the dealers recycle monitors they can not sell or that are broken beyond repair, while 12% throw them away.

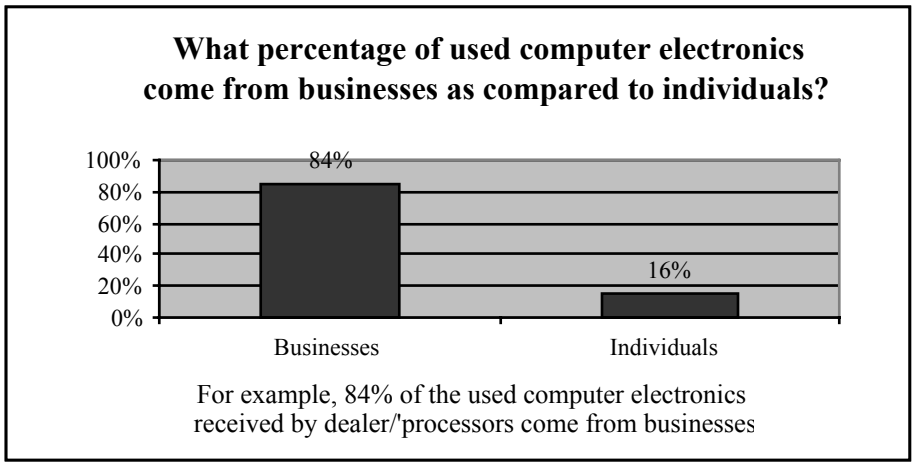
•92% of the dealers surveyed do not measure the amount of equipment they throw away.

•96% of the dealers are aware that computer electronics contain toxic materials potentially harmful to the environment.

•32% of the used equipment dealers/processors responding believe manufactures are solely responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment, while 16% believe it is the responsibility of manufacturers and dealer/processors (like themselves), 40% believe it is the responsibility of manufacturers and consumers, and 8% believe it is a responsibility shared by all.

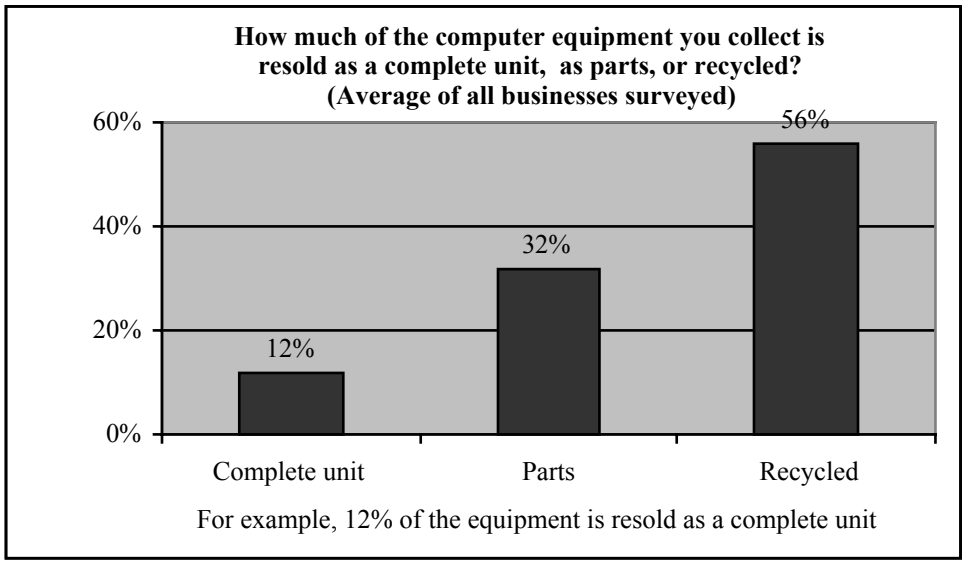
Survey Results:

Question C1: What percentage of the used computer electronics you accept or collect come from businesses as compared to individuals? Use computer equipment dealers and processors were asked to estimate the percentage of equipment acquired from businesses and individuals. The overwhelming majority reports their inventories coming from business users, citing the large business user as their largest and preferred customer. Dealers and processors work on the economy of scale, and acquiring larger inventories from businesses as opposed to individual items from households makes sense economically. In addition, it is much easier to schedule routine equipment pickups or deliveries with businesses as opposed to scheduling pick-ups with households

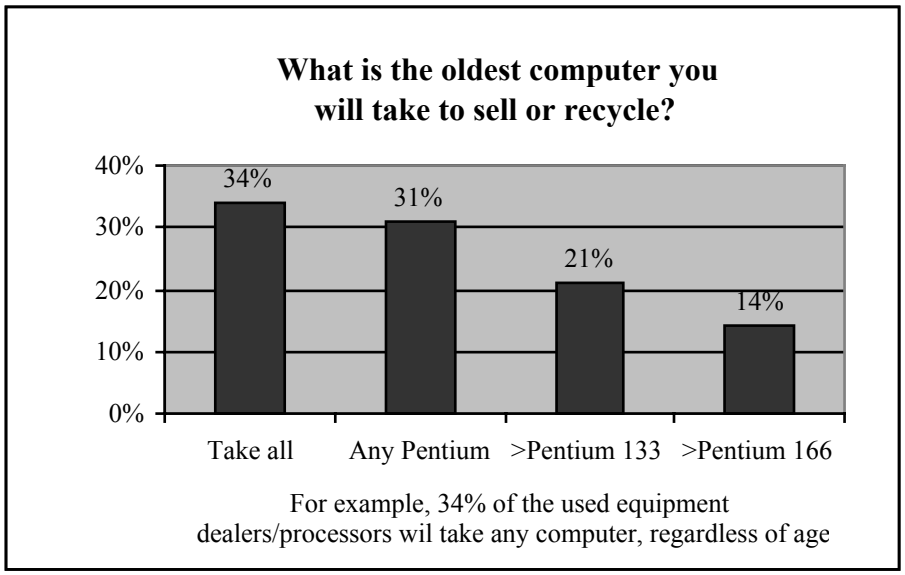


Question C2: Of the computer equipment you collect, how much is resold as a complete unit, demanufactured and sold as parts, or sent to a recycler?

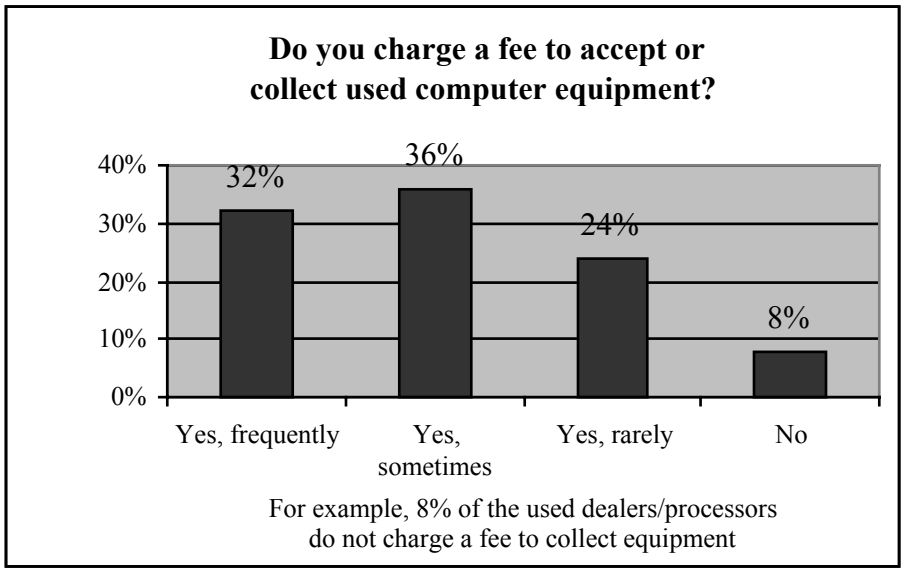
Similar to national statistics, the majority of computer equipment collected is not reused as a complete unit or as parts or components – but rather recycled. This is certainly not news to those in the business, and emphasizes the significance of consumers getting unused computer electronics out of storage as soon as possible. Although a valuable method of source reduction, the recycling process for recovery costs more and yields fewer benefits to the community than reuse.



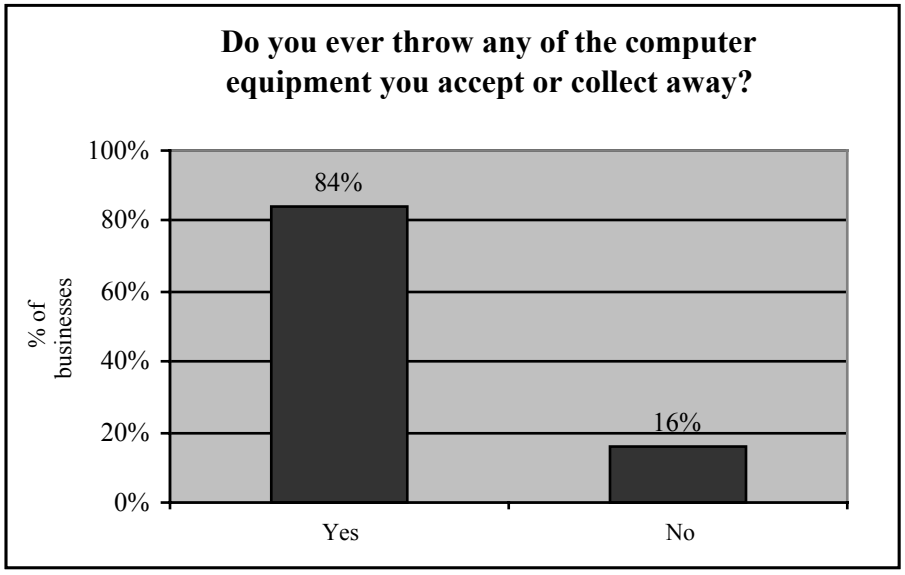
Question C3: What is the oldest computer you will accept or collect?



Question C4: Do you charge a fee to accept or collect used computer equipment? Almost all dealers surveyed charge a fee to accept or collect their customer's computer electronics. Those that don't stated the belief that if they did charge a fee for anything, the customer would not give them the more valuable items. Although not measured, all dealers were asked their opinion regarding whether or not charging a customer for some items influenced their decision to give the dealer the more current resalable items. The vast majority reports that this is no longer an issue with their customers, especially with larger businesses. The business community is more aware of the issues and costs associated with electronics collection and processing, and as long as the costs are reasonable, businesses are willing to pay for this service.

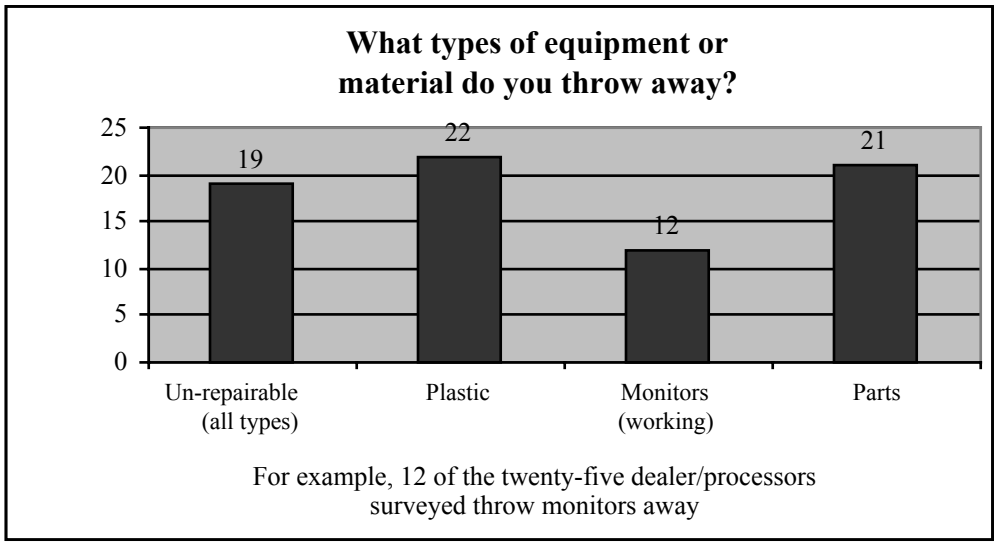


Question C5: Do you ever throw any of the computer equipment away?

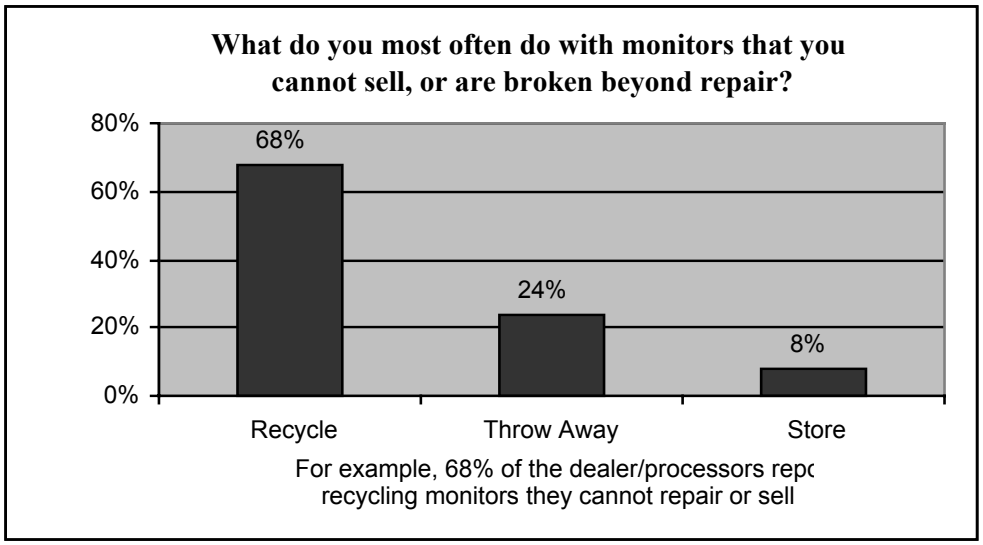


Question C6: What types of equipment or materials do you throw away?

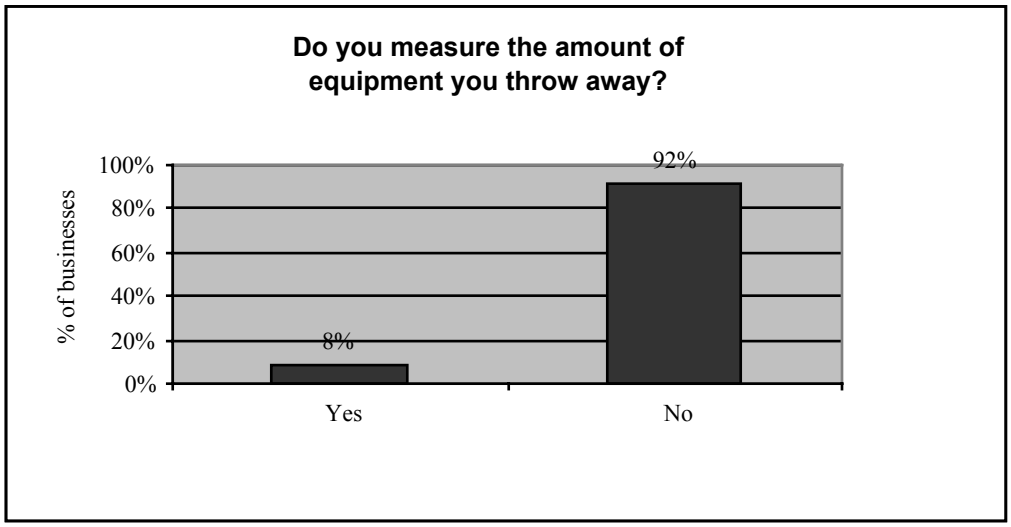
The category of un-repairable (all types) refers to any type of computer equipment or peripheral that is not working; and the category of monitors (working) refers to monitors that are working but of no perceived value. It is important to note, that although no distinction is made between the responses of larger and smaller dealers, smaller or storefront dealers are more inclined to throw equipment away.



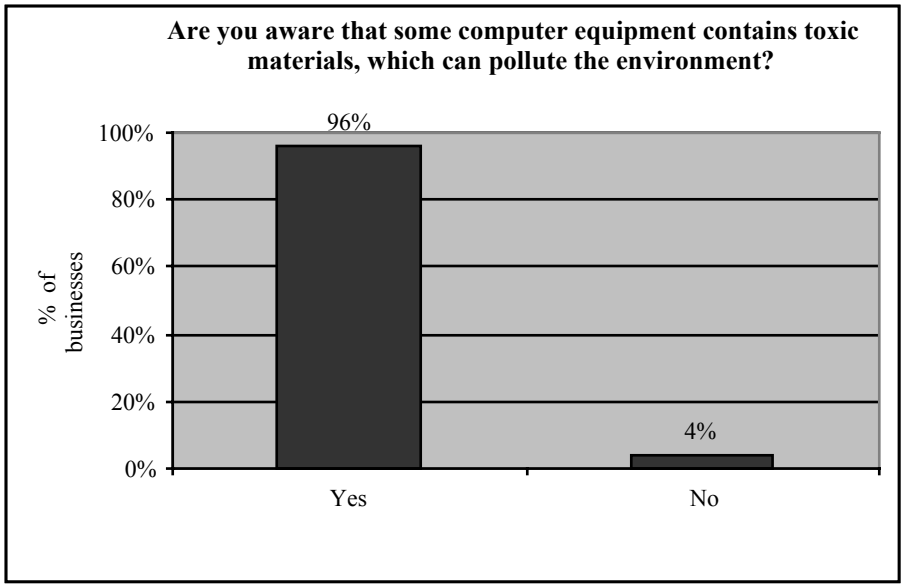
Question C7: What do you most often do with monitors that you cannot sell, or are broken beyond repair? Although opinions regarding computer equipment in general was surveyed in Question C6, actions taken with just monitors was reported here. It is important to note, that it is the smaller or storefront dealers who are more inclined to throw monitors away.



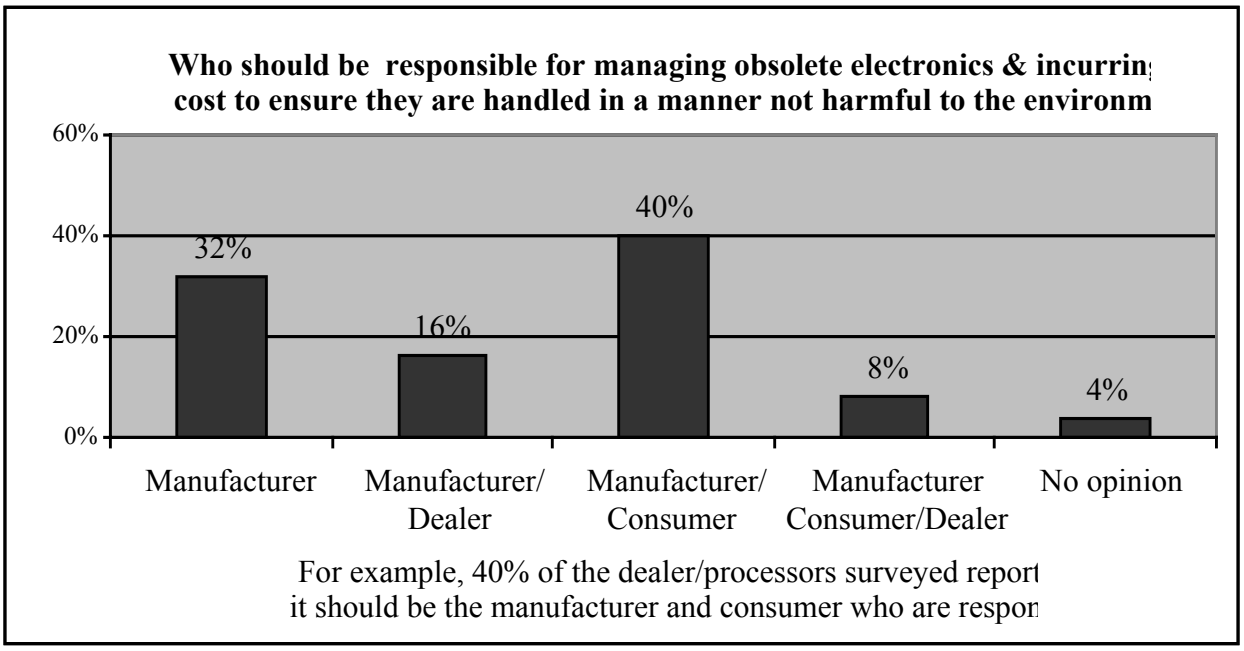
Question C8: Do you measure the amount of equipment you throw away?



Question C9: Are you aware that some computer equipment contains toxic materials, which have the potential to pollute the environment?



Question C10: Who should responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment? Used equipment dealers hold other stakeholder groups more accountable than themselves for this concern. When asked why, a common response from dealers was their belief that by the nature of their business, they were already incurring a high cost and a majority of the responsibility.



D. Dealers Selling New Computer Equipment

Phone surveys were conducted with 25 Missouri dealers in the business of selling new computer equipment. InfoUSA's Select Phone database was first utilized to identify all dealers by Standard Industrial Code (SIC). A sampling of dealers throughout the state was then selected. Not all businesses were chosen randomly, as some were specifically selected due to previous knowledge of their size – both large and small. Businesses representing larger retailers, as well as those operating out of smaller storefront enterprises were surveyed. All survey responses are reported as a percentage of the total.

Summary of Findings:

•60% of the dealers selling new computer equipment report that both household and business consumers replace an existing computer with a new one every 3-4 years.

•68% of dealers selling new computer equipment report a decrease in computer sales for the past 12 months. They also report steady growth in sales of peripherals, and a slightly higher growth rate for new monitor sales.

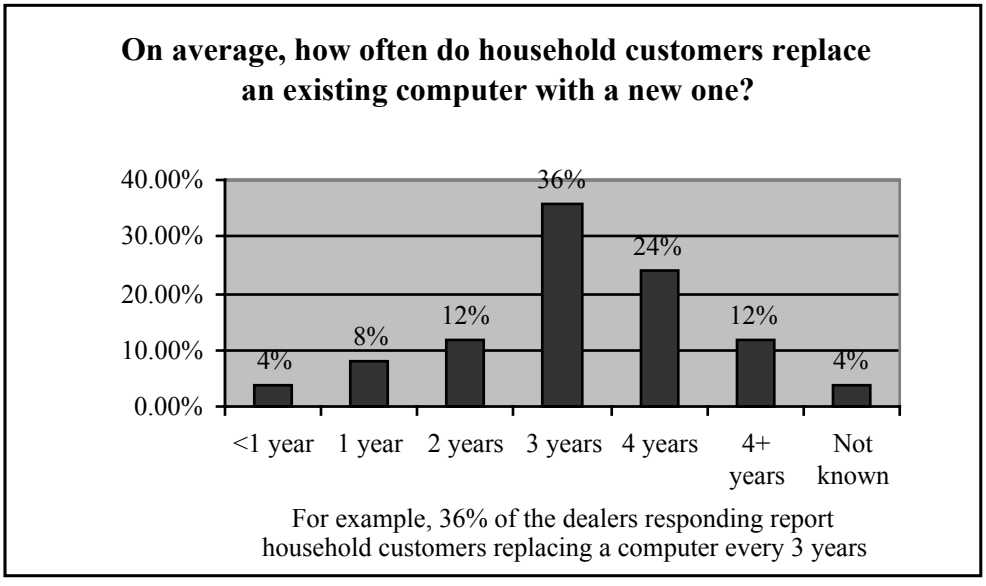
•92% of new equipment dealers are aware that some computer equipment contains toxic materials that are potentially harmful to the environment.

•44% of the new equipment dealers believe the burden of responsibility for managing obsolete electronics falls with the manufactures and consumers.

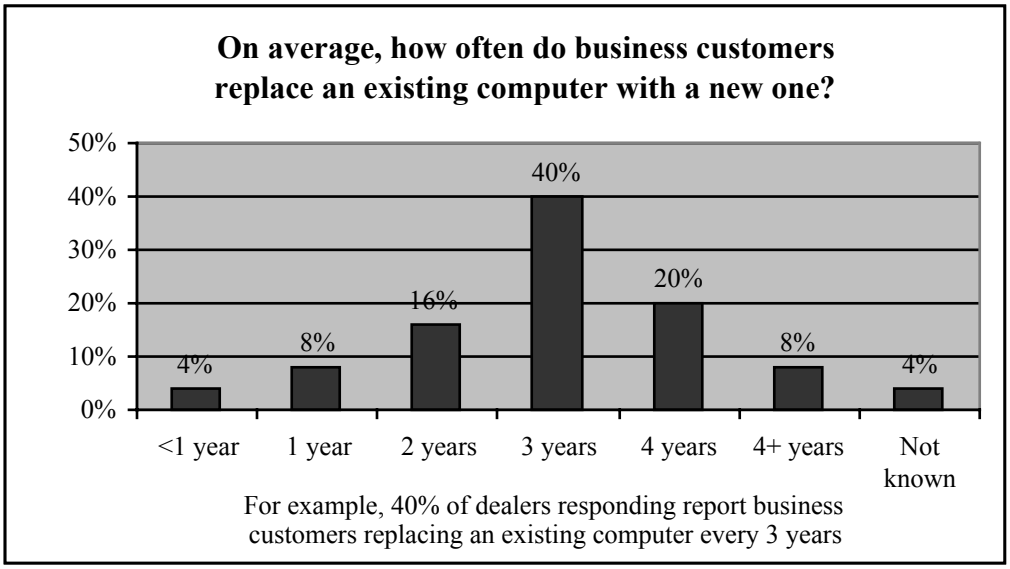
Survey questions:

Question D1: How often do household customers replace an existing computer?

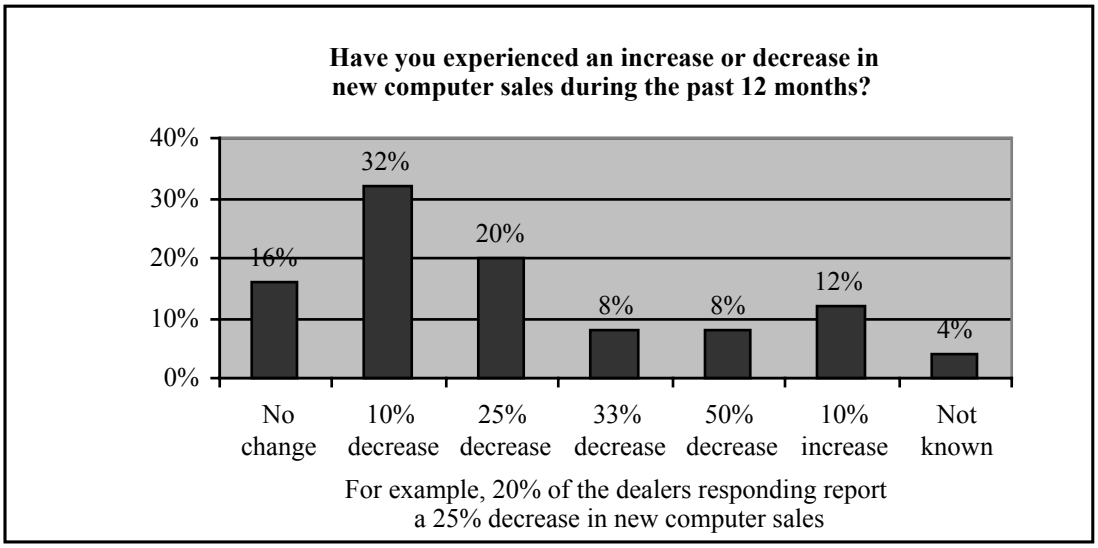
Dealers in Missouri report similar statistics to other dealers around the country. Responses by dealers are in line with how households answered when asked how often they purchased a new computer to replace an existing one (Question A4). Although not measured and reported, most dealers surveyed also report that in comparison with previous years, household customers seem to be holding on to computers for an additional 6-12 months. Dealers also report an increase in new monitor sales to household consumers, particularly larger 19" and above, and flat panel screen models.



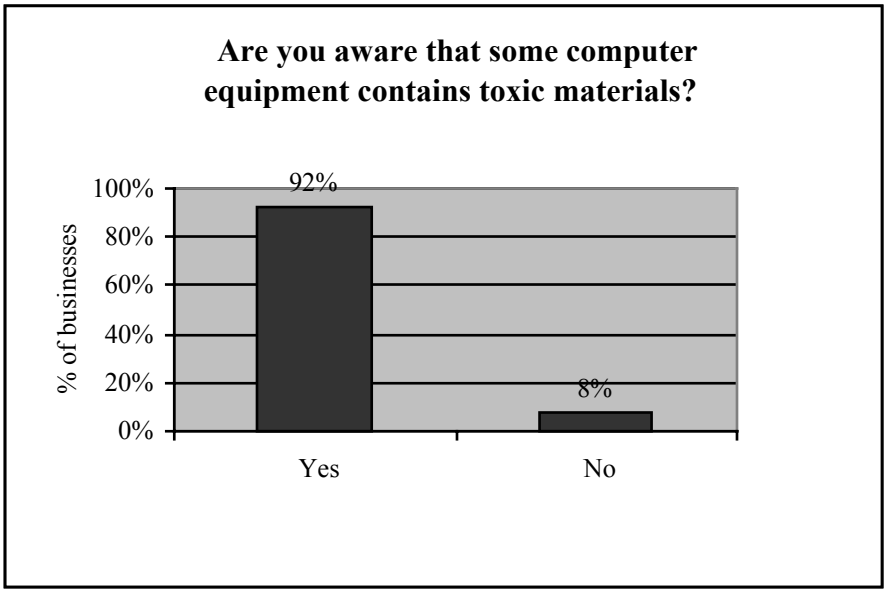
Question D2: How often do business customers replace an existing computer with a new one? Although gauged from a relatively small sample, it seems business consumers' new computer buying habits are very similar to household consumers. Responses by dealers are in line with the how business consumers answered when asked how often they purchased a new computer to replace an existing one (Question B4). Although not measured and reported, most dealers surveyed also report that in comparison with previous years, business customers seem to be holding on to computers for an additional 6-12 months before buying a new one.



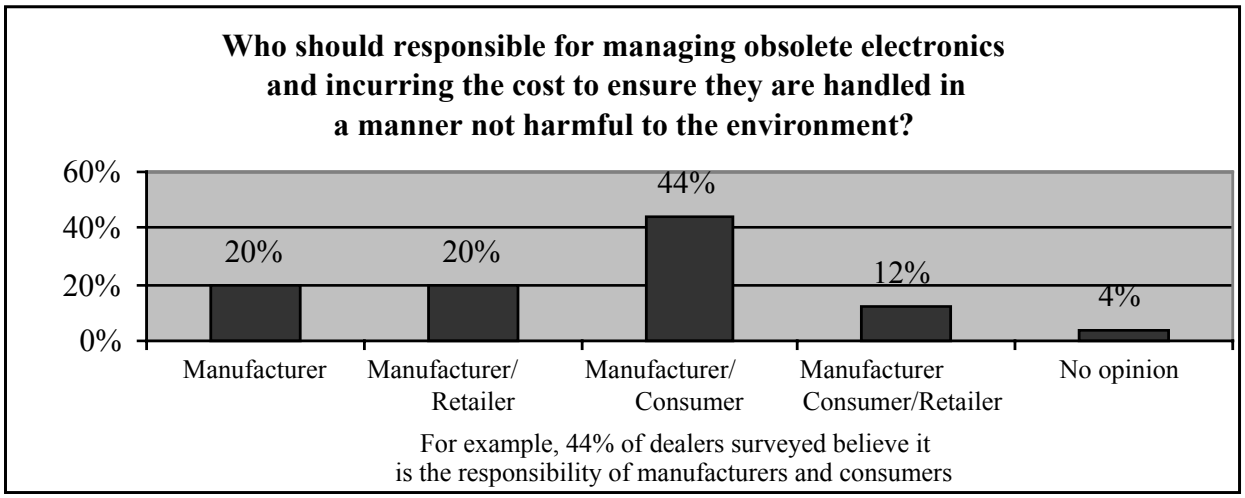
Question D3: Have you experienced an increase or decrease in new computer sales during the past 12 months? The majority, 68% of dealers selling new computers, reports a decrease in general sales for the past 12 months. The larger retailers report that peripheral sales have increased at what seems to be a normal growth rate, and new monitor sales seem to be up more than usual.



Question D4: Are you aware that some computer equipment contains toxic materials, which can pollute the environment?



Question D5: Who should be responsible for managing obsolete electronics and incurring the cost to ensure they are handled in a manner not harmful to the environment? Like their counterparts selling used computer equipment, dealers selling new equipment hold other stakeholder groups more accountable than themselves for this concern.



E. Household Consumers Using Televisions:

Phone surveys with 100 household consumers, 18 years or older, were conducted utilizing InfoUSA's Select Phone database. Geographic areas were targeted to represent a sampling of metropolitan, suburban and rural areas. Then, within these targeted areas, phone numbers were chosen randomly. With the exception of Question #E6, which reports methods used to manage obsolete televisions, all survey responses are reported as a percentage of the total.

Summary of Findings:

•16% of the households responding report having only one television currently in use at home; 41% have two, and 42% have three or more.

•67% of the households responding do not have an used television at the home, while 24% have one, 9% have two, and 2% have three or more.

•52% of all televisions accounted for are under three-years old, while 44% are three-years or older. 22% of the households report purchasing a new television at least every two years, while 47% do so every three to four years.

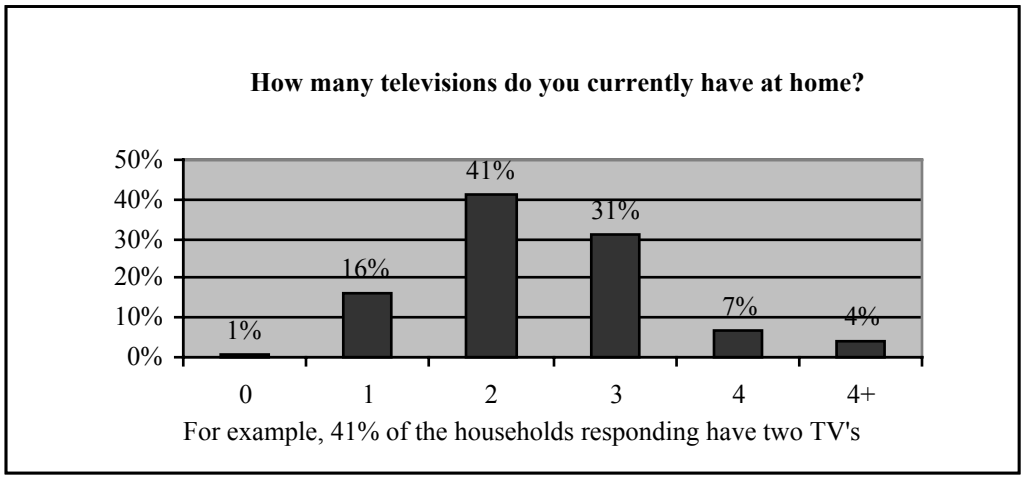
•65% of the households surveyed has thrown away, or plans to throw away a used television. When asked what they believed to be the best method for getting rid of an unused television, 35% thought throwing the TV to be the best (often described as easiest), 19% stated donation, and 10% recycling. When asked why they did not chose recycling or donation (for working TV's), most said they had not thought of those options, or they did not know how to find someone to recycle the television.

•Reasons given for not getting rid of used televisions included: 34% of respondents believe they will use the television again, and 21% believe the television is too valuable to get rid of.

•Only 21% of the respondents acknowledged knowing that televisions contain toxic materials, which have the potential to pollute the environment. Even after being told that special handling is required to prevent a television's toxic materials from polluting the environment, 47% of the household stated that no fee should charged to have their unused television disposed of, 33% were willing to pay less then $5, and 10% said they would pay between $15-$20 dollars.

Survey Questions:

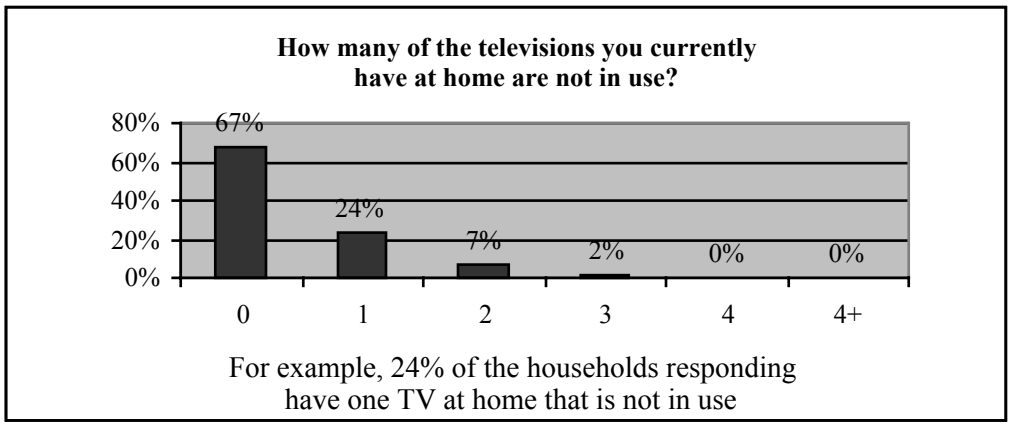
Question E1: How many televisions do you currently have at home, which are in use? Respondents were asked to account for only televisions that are currently being used. Televisions described by the respondent as "being used only once in awhile", were considered "in use" and counted for this question.



For example, 41% of the households responding have two TV's

Question E2: How many televisions in the home are not in use?

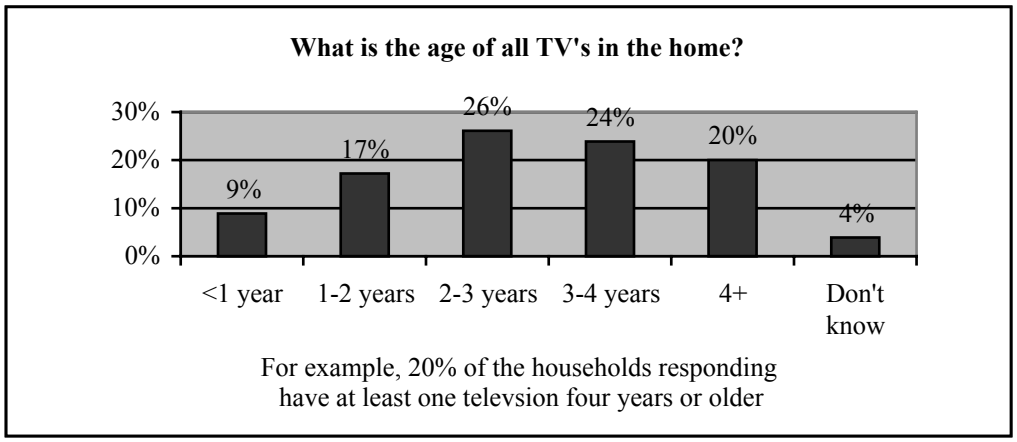
Respondents were then asked to account for *only* the televisions not currently being used, working or not. Televisions described by the respondent as "being used only once in awhile", were considered "in use" and not counted for this question. When respondents were asked why a television was unused, one of three answers was given: 1) the TV was broken; 2) they had replaced the TV with a newer model, and even though the old one was working, they had not gotten around to doing something with it; 3) they did not have a use for the working TV right now, but might at a future time.



For example, 24% of the households responding have one TV at home that is not in use

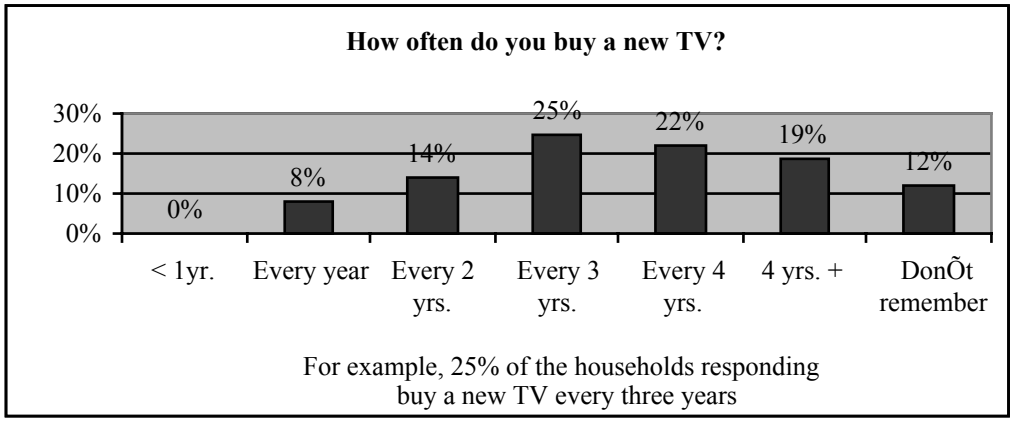
Question E3: What is the age of all televisions in the home?

Respondents were asked to report the age of all televisions in the home. When not sure, the researcher prompted the respondents by repeating the choice of age ranges. It was clear to the researcher that the respondents' answers, in most cases, were only approximations as most respondents were unable to remember the exact date the television was purchased.

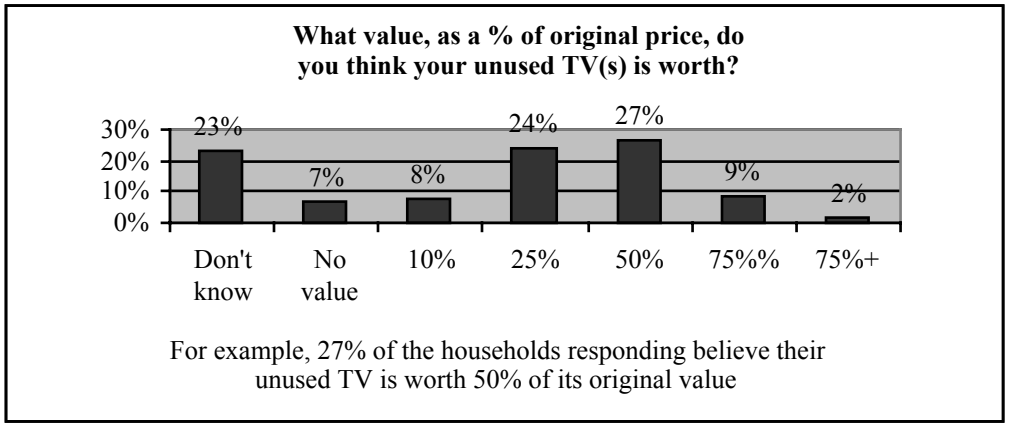


Question E4: How often do you buy a new television?

Respondents were asked how often they purchased a new television. When respondents were asked why they bought a new television, the most common responses, in order of frequency, were: 1) to replace a working television with a newer model; 2) to replace a broken television; 3) not as a replacement, but to add an additional television to the household.

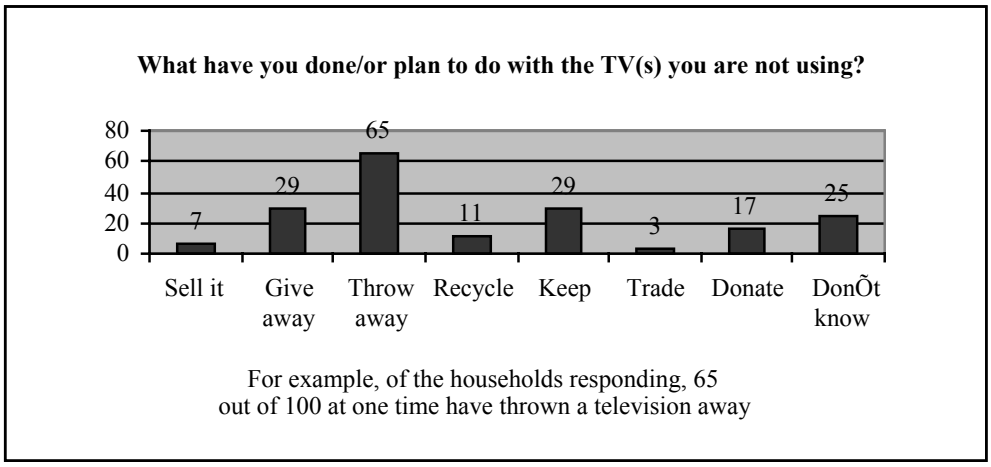


Question E5: What value, as a percent of the original price, do you think the television(s) you are not using is worth? By asking this question, the researcher wanted to determine if perceived value was a factor for households holding on to unused televisions. The researcher prompted the respondents by asking, (and repeating if necessary), "Do you think the television has no value, or is worth 10%, 25%, 50%, 75%, or more than 75% of its original value?"



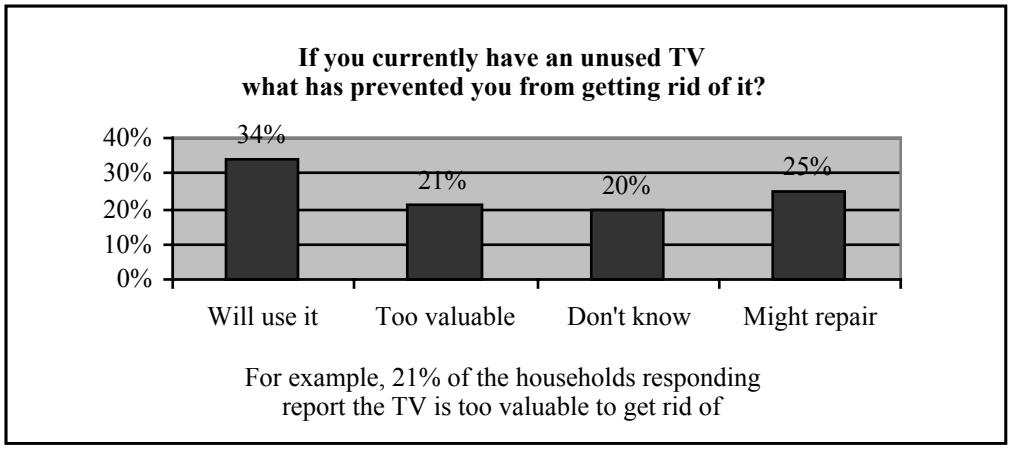
For example, 27% of the households responding believe their unused TV is worth 50% of its original value

Question E6: What have you done, or plan to do with the television(s) you are not currently using? To determine the respondents' unsolicited opinion, the question was first asked without listing any choices. If required, the researcher then prompted the respondents by reading the list of choices. It is important to note the difference between the choices of "Give away" - which was described as giving the television to anyone other than a nonprofit organization, charity, school or religious entity; and "Donate" – which was described as giving it to a nonprofit organization, charity, school or religious entity. By far, the most common method was to throw the television away. The number of responses is greater than the number of respondents due to fact that many of the respondents reported various choices taken in the past.

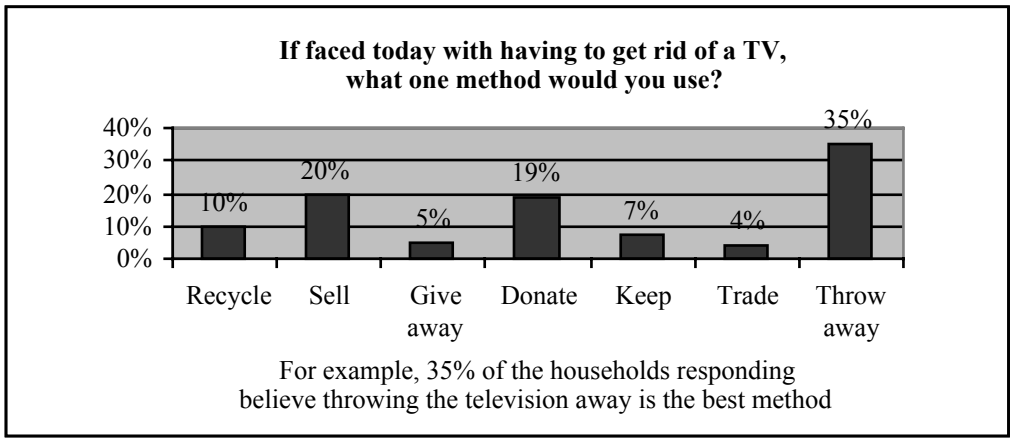


For example, of the households responding, 65 out of 100 at one time have thrown a television away

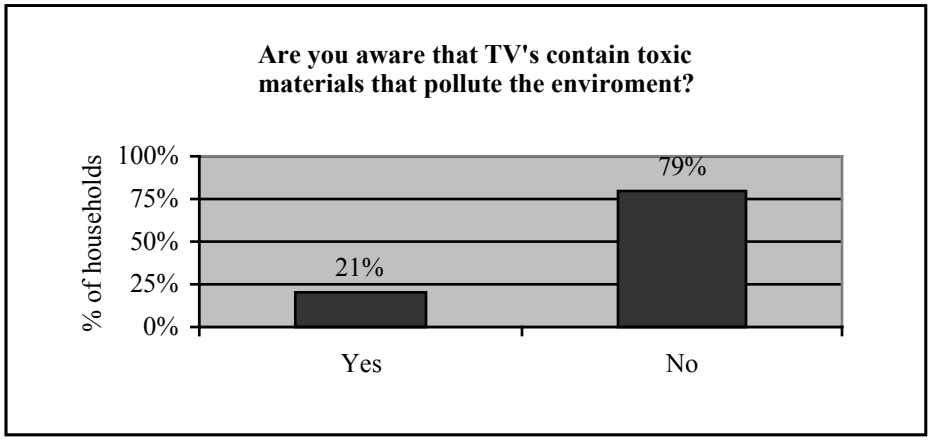
Question E7: If you currently have a television at home, which you are not using, what is preventing you from getting rid of it? Although with less frequency than with computer equipment, it is believed that households tend to store unused televisions, even if they are working. Understanding why will help develop future management strategies and ways to motivate people to mange equipment before it truly does become obsolete and while it is still reusable. Again, the question was asked without prompting. If required, the researcher then asked the respondents if they believed they might use it someday, or if the television was too valuable to consider getting rid of it at this time.



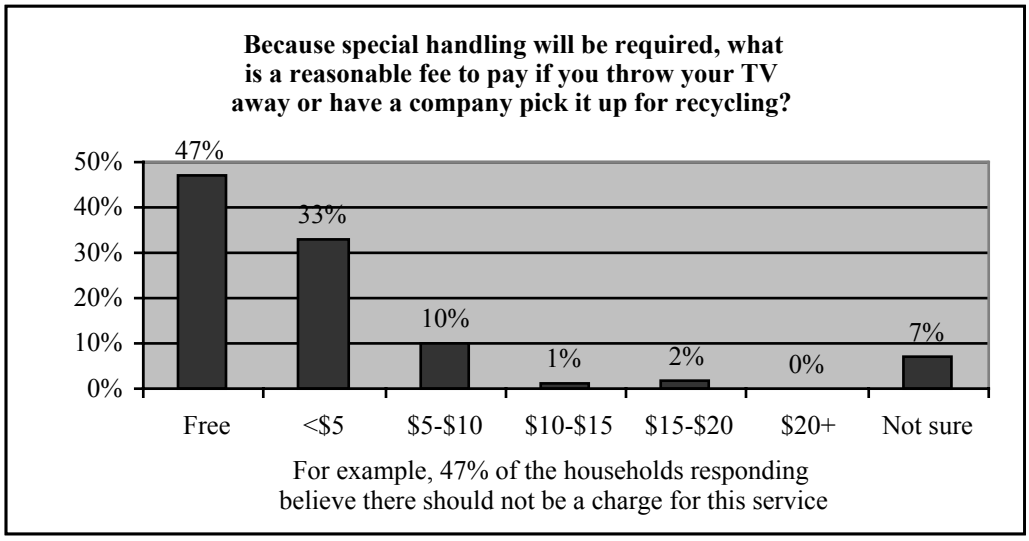
Question E8: If faced today with having to get rid of an unused television, what one method would you chose? Although asked what they had done in the past, or plan to do in the future, the researcher believed it important to have the respondents state a preferred means of disposal or management. Responses to this question are consistent with Question #E6 and what households had done in the past – which is to throw televisions away. When asked why they did not chose recycling or donation (for working TV's), most said they had not thought of those options, or they did not know how to find someone to recycle the television.



Question E9: Are you aware that televisions contain toxic materials, which have the potential to pollute the environment? This question was asked to determine respondents' awareness of the impact television disposal could have on the environment. In hindsight, it would have been informative to then ask, if now knowing this, would it affect their preferred method of disposal. These results reinforce the belief that any strategies developed to effectively manage the targeted materials should include an educational component.



Question E10: Because special handling will be required to prevent televisions from polluting the environment, most likely a fee will be charged if you throw away your television or have a company pick it up for recycling. This being the case, what is a reasonable amount to pay for this service? It was explained to the respondents that the fee would ensure that the equipment would be handled correctly, minimizing harm to the environment. In comparison to the same question regarding computer disposal, a larger percentage of households believe there should not be a fee for handling televisions, and there was much more discussion questioning why a fee should be charged. Comments such as, "I didn't have to pay before, why should I now?" were very common.



F. National Estimates:

This section reports national estimates of new computer electronics being shipped, existing computer electronics becoming obsolete, and a breakdown between obsolete electronics being recycled and those who's end-of-life cannot be identified. As stated in the Methodology narrative, estimations were determined utilizing published data from reputable and informed sources, and then applying historical trends to forecast current and future amounts. The National Safety Council's (NSC) 1999 Electronic Product Recovery and Recycling Baseline Report – Recycling of Selected Electronic Products in the United States, was utilized as the primary source for establishing the starting point for new units shipped, units becoming obsolete, and obsolete units being recycled. NSC's future projections, as stated in the 1999 report, were then amended with more recent data to determine projections. All projections for the number of targeted electronics becoming obsolete, and those reused and recycled vs. those that are not, do not take into account future strategies and programs for better electronics management and product stewardship. Both NSC's chart and the researcher's amended chart reporting yearly new computer shipments and number of computers becoming obsolete can be found in Appendix I.

Summary of Findings:

•For the years 2003 and 2004 the number of computers becoming obsolete will surpass the number of new computers shipped. The number of obsolete computers will begin to decline starting in 2004, and possibly begin to increase again in the year 2007. The decrease in obsolete computers will be a direct result of the slowdown in new computer sales for the years 2001 through 2004. The increase of obsolete computers, beginning in 2007, reflects a higher growth rate for new sales beginning in 2005.

•Year after year, the estimated number of obsolete computers not recycled, overwhelming exceeds the number of obsolete computers which are reused or recycled. For the years 2001-2007, it is estimated that a total of 334 million computers will become obsolete nationally.

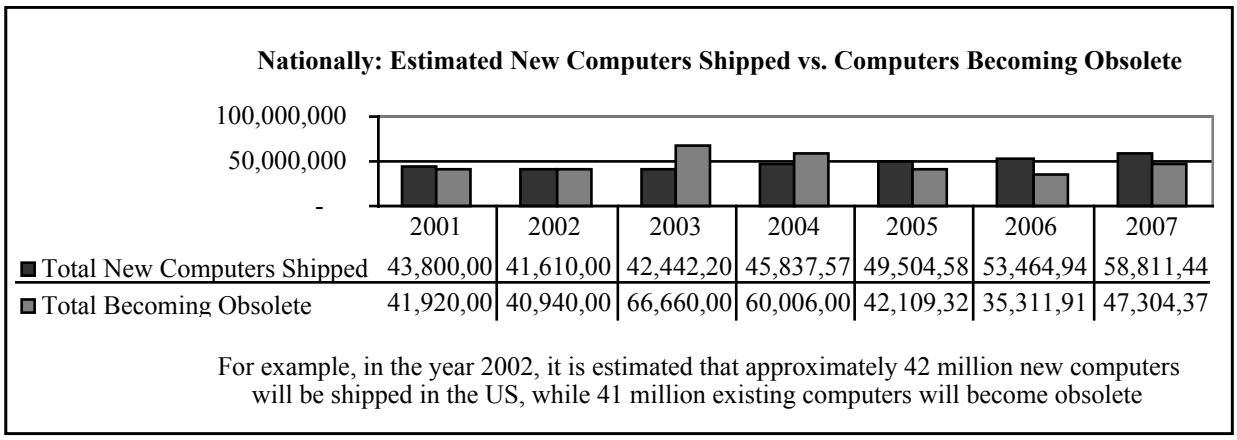
•Of the 334 million computers becoming obsolete, only 37 million (11%) will be recycled, leaving 297 million (89%) unaccounted for. The assumption can be made that those unaccounted for are left in storage or thrown away.

•New CRT monitors shipped will continue to show growth, and it is estimated that new units shipped will continue to surpass those becoming obsolete from 2001-2007. Although new computer system sales have declined, and anticipated growth is predicted to be smaller than previously estimated, this is not the case for the "after sale" market of new CRT monitors. More innovative products, specifically larger CRT's and flat panel LCD models, at prices tolerable to the consumer, will continue to drive the CRT monitor market.

•Although it is predicted that CRT monitors becoming obsolete will not surpass the number of new CRT monitors sold, the number of obsolete CRT's will steadily grow, reflecting the consumer's enchantment with newer less expensive product, and their willingness to discard older models. Of the 178 million CRT monitors becoming obsolete from 2001-2007, it is estimated that only 17 million (10%) will be reused or recycled, and conversely, 161 million (90%) will be unaccounted for.

•Accurate numbers for all new peripherals shipped was not obtainable. Data pertaining to the number of peripherals becoming obsolete varies according to the source. It is estimated that from 2001-2007, a total of 127 million will become obsolete nationally. Of those, only 33 million (24%) will be reused or recycled, and 94 million (76%) unaccounted for.

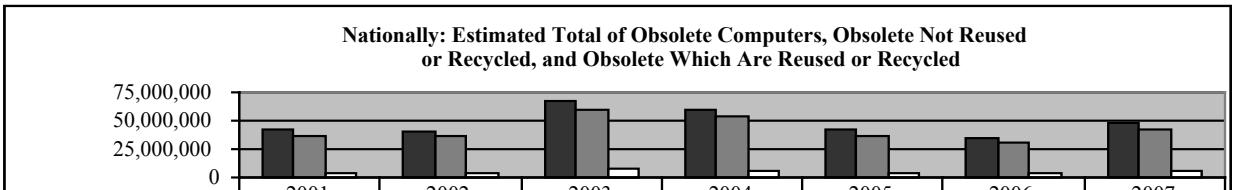
Graph F1: Nationally: Comparing of new computers shipped to computers becoming obsolete.



	2001	2002	2003	2004	2005	2006	2007
Total New Computers Shipped	43,800,00	41,610,00	42,442,20	45,837,57	49,504,58	53,464,94	58,811,44
Total Becoming Obsolete	41,920,00	40,940,00	66,660,00	60,006,00	42,109,32	35,311,91	47,304,37

For example, in the year 2002, it is estimated that approximately 42 million new computers will be shipped in the US, while 41 million existing computers will become obsolete

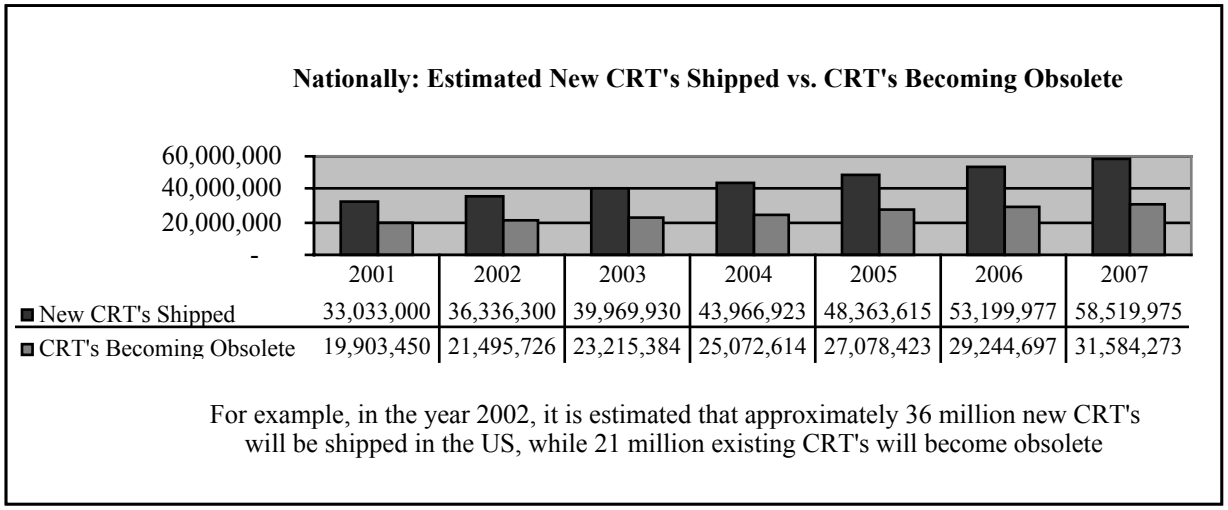
Graph F2: Nationally: Comparing obsolete computers that are reused or recycled to those that are not.



	2001	2002	2003	2004	2005	2006	2007
Total Obsolete	41,920,000	40,940,000	66,660,000	60,006,000	42,109,320	35,311,910	47,304,378
Not Reused/Recycled	37,308,800	36,436,600	59,327,400	53,405,340	37,477,295	31,427,600	42,100,896
Reused/Recycled	4,611,200	4,503,400	7,332,600	6,600,660	4,632,025	3,884,310	5,203,482

For example, in the year 2002, it is estimated that of the 41 million computers becoming obsolete, approximately 4.5 million will be recycled or reused and 36 million will not

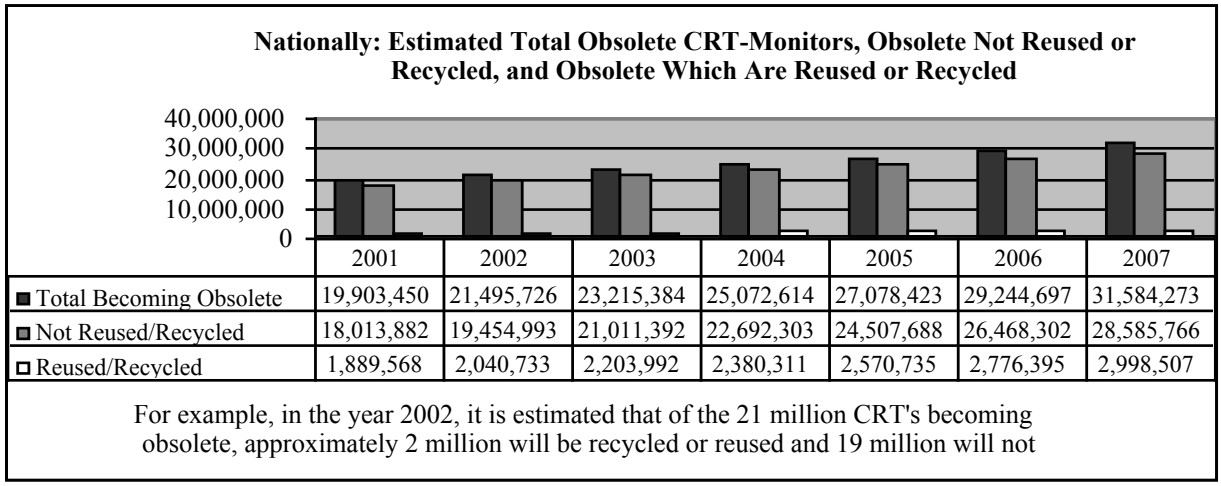
Graph F3: Nationally: Comparing new CRT-monitors shipped to CRT-monitors becoming obsolete.



	2001	2002	2003	2004	2005	2006	2007
New CRT's Shipped	33,033,000	36,336,300	39,969,930	43,966,923	48,363,615	53,199,977	58,519,975
CRT's Becoming Obsolete	19,903,450	21,495,726	23,215,384	25,072,614	27,078,423	29,244,697	31,584,273

For example, in the year 2002, it is estimated that approximately 36 million new CRT's will be shipped in the US, while 21 million existing CRT's will become obsolete

Graph F4: Nationally: Comparing obsolete CRT monitors that are reused or recycled to those that are not.

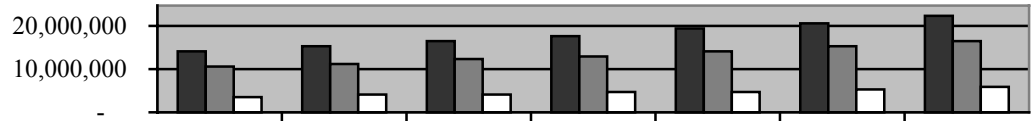


	2001	2002	2003	2004	2005	2006	2007
Total Becoming Obsolete	19,903,450	21,495,726	23,215,384	25,072,614	27,078,423	29,244,697	31,584,273
Not Reused/Recycled	18,013,882	19,454,993	21,011,392	22,692,303	24,507,688	26,468,302	28,585,766
Reused/Recycled	1,889,568	2,040,733	2,203,992	2,380,311	2,570,735	2,776,395	2,998,507

For example, in the year 2002, it is estimated that of the 21 million CRT's becoming obsolete, approximately 2 million will be recycled or reused and 19 million will not

Graph F5: Nationally: Comparing obsolete peripherals that are reused or recycled to those that are not.

Nationally: Estimated Total Obsolete Peripherals, Obsolete Not Reused or Recycled, and Obsolete Which Are Reused or Recycled



	2001	2002	2003	2004	2005	2006	2007
Total Becoming Obsolete	14,234,746	15,373,525	16,603,407	17,931,680	19,366,214	20,915,511	22,588,752
Not Reused/Recycled	10,533,712	11,376,409	12,286,521	13,269,443	14,330,999	15,477,478	16,715,677
Reused/Recycled	3,701,034	3,997,117	4,316,886	4,662,237	5,035,216	5,438,033	5,873,076

For example, in the year 2002, it is estimated that approximately 15 million peripherals will become obsolete, and of those, approximately 4 million will be recycled or reused and 11 million will not

G. Missouri Future Projections:

This section is specific to the state of Missouri, and reports: 1) projections of new computer electronics shipped; 2) obsolete computer electronics and televisions being reused and recycled - and those that are not; 3) a breakdown of obsolete computer electronics generated by businesses and households; 4) and estimates of what Missouri citizens will do with obsolete computer electronics and televisions from 2001-2007. Estimates for Missouri were determined by utilizing national data from reputable and informed sources, then based on the proper context were either prorated by Missouri's demographics, or by applying the results of the stakeholders' surveys. Estimates and projections do not take into account future national or state strategies or programs for better electronics management and product stewardship.

Summary of Findings:

•As Missouri estimations are based on national trends, the number of computers becoming obsolete will surpass the number of new computers shipped in 2003 and 2004. It is estimated that a total of 6.8 million computers will become obsolete from 2001-2007.

•Of the 6.8 million computers becoming obsolete in Missouri from 2001-2007, 3.8 million will come from businesses and 3 million from households.

•The estimated number of computers becoming obsolete in Missouri, which are not reused or recycled, overwhelming exceeds the numbers that will be. Of the 6.8 million computers becoming obsolete from 2001-2007, it is estimated that only 748,000(11%) will be reused or recycled, leaving 6 million (89%) that will be stored or thrown away.

•It is estimated that 6.4 million new CRT monitors will be shipped to Missouri during 2001-2007. During that same time period, 3.6 million existing CRT monitors will have become obsolete.

•Only 343,000 (10%) of the obsolete CRT monitors generated in Missouri during 2001-2007 will be reused or recycled, and 3.3 million (90%) will remain in storage or thrown away.

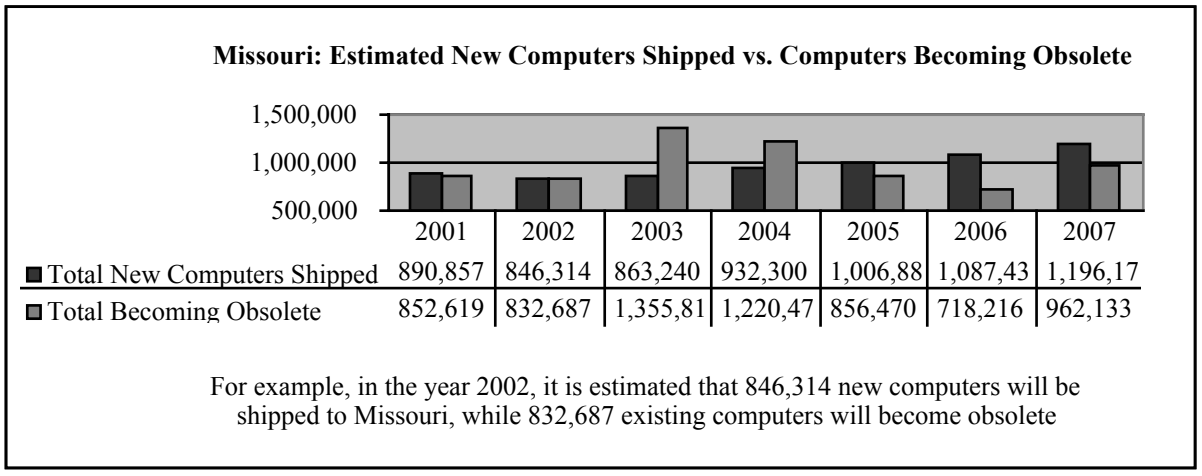
•Of the 3.6 million CRT monitors becoming obsolete in Missouri during 2001-2007, 1.6 million will come from households, and 2 million from businesses.

•It is estimated that from 2001-2007, a total of 2.6 million peripherals will become obsolete. Of those, 672,000 (26%) will be reused or recycled, and the balance, 1.9 million (74%) will be stored or thrown out.

• Of the estimated 2.6 million peripherals becoming obsolete in Missouri, 1.1 million will come from households and 1.4 million from businesses.

• The estimated number of televisions becoming obsolete in Missouri from 2001-2007 is 2.5 million. Of that total, only 250,000 (10%) will be reused or recycled, and 2.2 million (90%) will be stored or thrown away. Some predictions increase the number of obsolete TV's by 25%-50% starting in the year 2005. This is based the Federal Communications Commission requirement that television broadcasters will have to complete the transition from analog to digital transmission signals by the end of the year 2006. It is possible that the required date may change, but non-the-less, the replacement of analog televisions with high definition televisions (HDTV) will occur soon. Although sales of HDTV have been slower than the industry expected, this is expected to change, as digital signals are more readily available. Solid waste professionals are concerned with the additional amount of E-waste this dramatic conversation will cause.

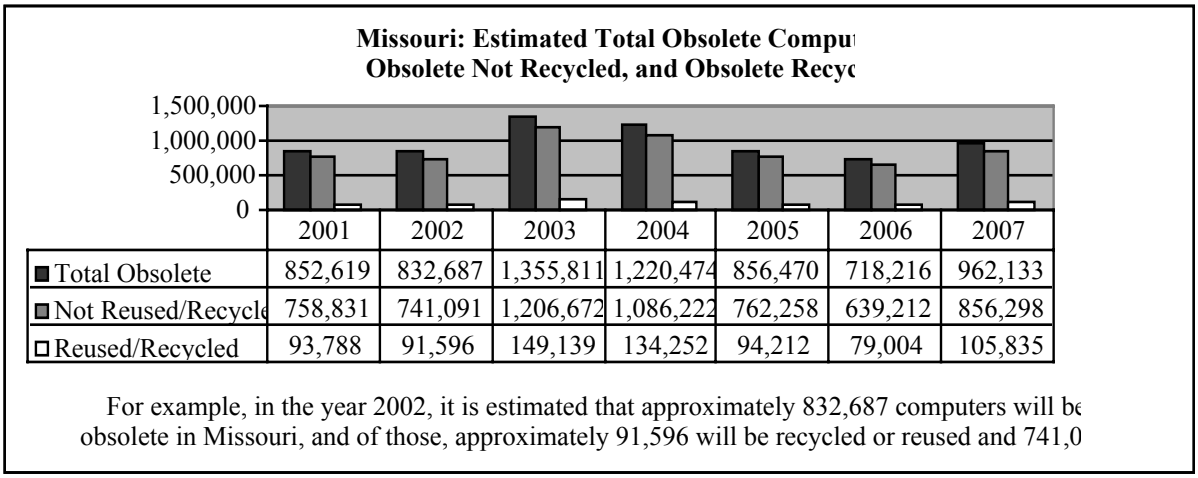
Graph G1: Missouri comparison of new computers shipped and computers becoming obsolete.



	2001	2002	2003	2004	2005	2006	2007
Total New Computers Shipped	890,857	846,314	863,240	932,300	1,006,88	1,087,43	1,196,17
Total Becoming Obsolete	852,619	832,687	1,355,81	1,220,47	856,470	718,216	962,133

For example, in the year 2002, it is estimated that 846,314 new computers will be shipped to Missouri, while 832,687 existing computers will become obsolete

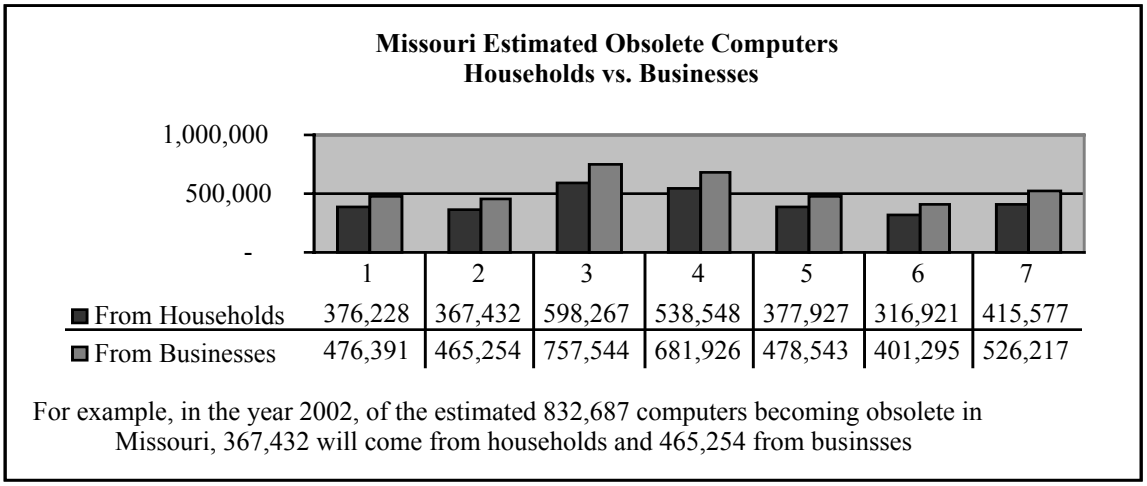
Graph G2: Missouri: Comparison of obsolete computers that are reused or recycled to those that are not.



	2001	2002	2003	2004	2005	2006	2007
Total Obsolete	852,619	832,687	1,355,811	1,220,474	856,470	718,216	962,133
Not Reused/Recycle	758,831	741,091	1,206,672	1,086,222	762,258	639,212	856,298
Reused/Recycled	93,788	91,596	149,139	134,252	94,212	79,004	105,835

For example, in the year 2002, it is estimated that approximately 832,687 computers will be obsolete in Missouri, and of those, approximately 91,596 will be recycled or reused and 741,0

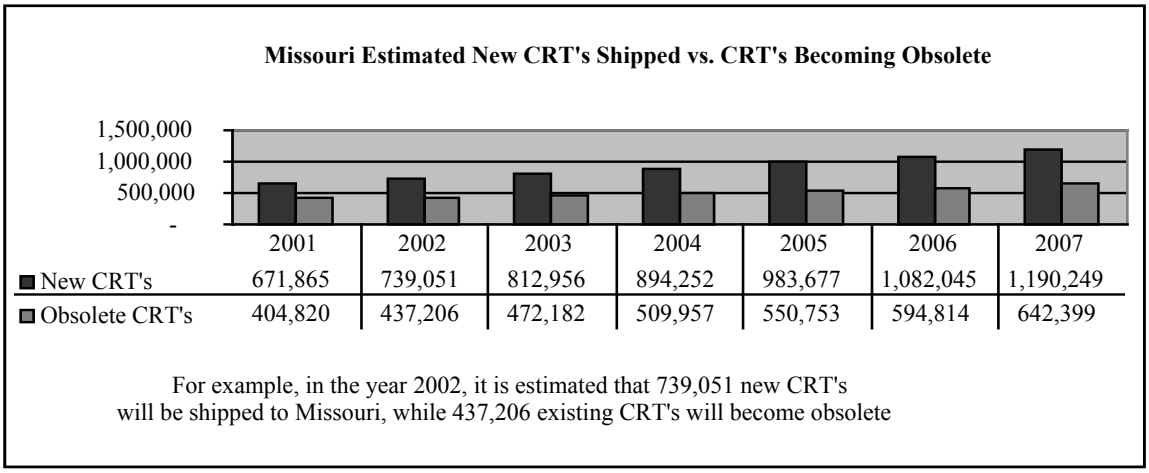
Graph G3: Missouri: Comparison of total obsolete computers generated by households and businesses.



	1	2	3	4	5	6	7
From Households	376,228	367,432	598,267	538,548	377,927	316,921	415,577
From Businesses	476,391	465,254	757,544	681,926	478,543	401,295	526,217

For example, in the year 2002, of the estimated 832,687 computers becoming obsolete in Missouri, 367,432 will come from households and 465,254 from businsses

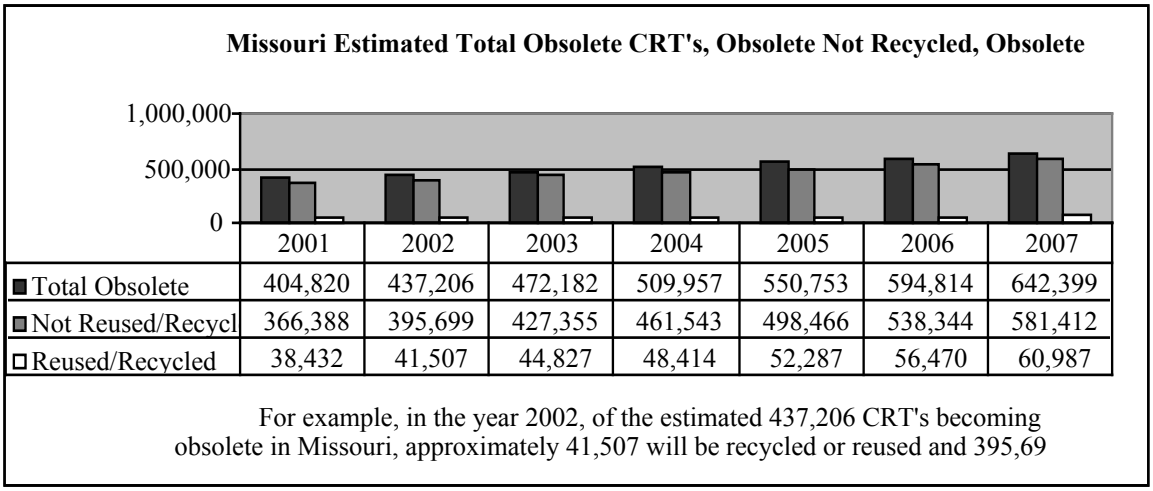
Graph G4: Missouri: New CRT-monitors shipped and CRT-monitors becoming obsolete.



	2001	2002	2003	2004	2005	2006	2007
New CRT's	671,865	739,051	812,956	894,252	983,677	1,082,045	1,190,249
Obsolete CRT's	404,820	437,206	472,182	509,957	550,753	594,814	642,399

For example, in the year 2002, it is estimated that 739,051 new CRT's will be shipped to Missouri, while 437,206 existing CRT's will become obsolete

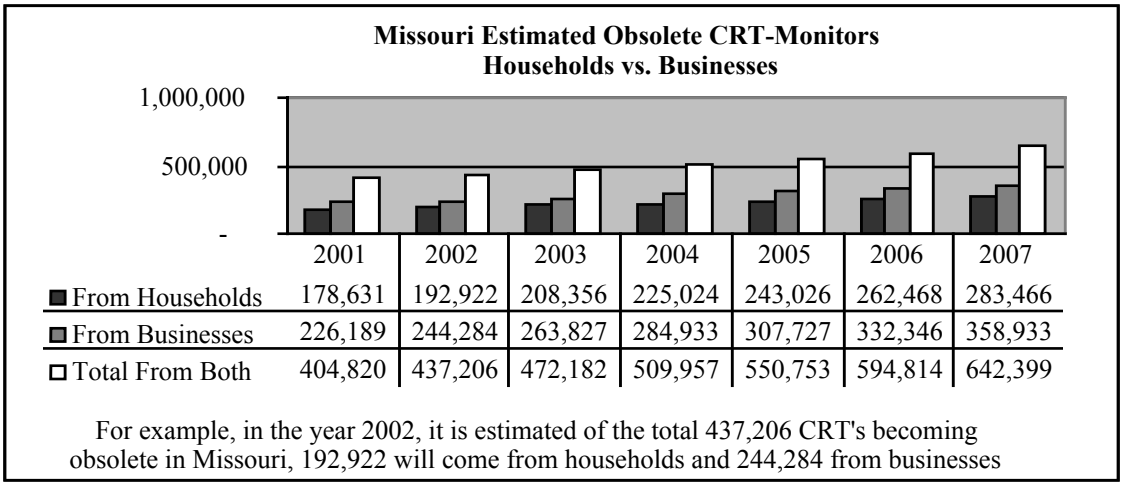
Graph G5: Missouri: Total obsolete CRT-monitors that are reused or recycled to those that are not.



	2001	2002	2003	2004	2005	2006	2007
Total Obsolete	404,820	437,206	472,182	509,957	550,753	594,814	642,399
Not Reused/Recycl	366,388	395,699	427,355	461,543	498,466	538,344	581,412
Reused/Recycled	38,432	41,507	44,827	48,414	52,287	56,470	60,987

For example, in the year 2002, of the estimated 437,206 CRT's becoming obsolete in Missouri, approximately 41,507 will be recycled or reused and 395,69

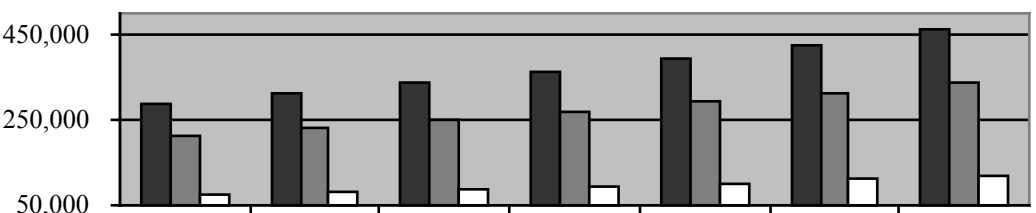
Graph G6 Missouri: Comparison of total obsolete CRT-monitors generated by households and businesses.



	2001	2002	2003	2004	2005	2006	2007
From Households	178,631	192,922	208,356	225,024	243,026	262,468	283,466
From Businesses	226,189	244,284	263,827	284,933	307,727	332,346	358,933
Total From Both	404,820	437,206	472,182	509,957	550,753	594,814	642,399

For example, in the year 2002, it is estimated of the total 437,206 CRT's becoming obsolete in Missouri, 192,922 will come from households and 244,284 from businesses

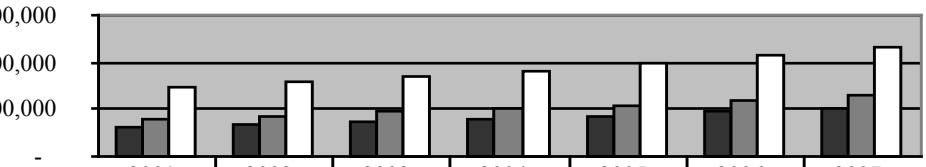
Graph G7 Missouri: Comparison of obsolete peripherals that are reused or recycled to those that are not.



	2001	2002	2003	2004	2005	2006	2007
Total Obsolete	289,523	312,685	337,700	364,716	393,893	425,405	459,437
Not Reused/Recycled	214,247	231,387	249,898	269,890	291,481	314,800	339,983
Reused/Recycled	75,276	81,298	87,802	94,826	102,412	110,605	119,454

For example, in the year 2002, it is estimated that approximately 312,685 peripherals will become obsolete in Missouri, and of those, approximately 81,298 will be recycled or reused and 231,387 will not

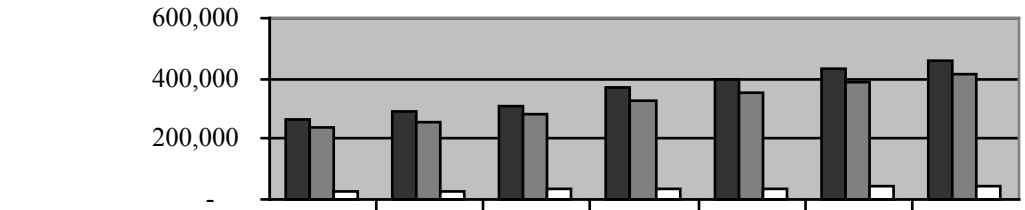
Graph G8: Missouri: Comparison of total obsolete peripherals generated by households and businesses.



	2001	2002	2003	2004	2005	2006	2007
From Households	127,755	137,976	149,014	160,935	173,810	187,715	202,732
From Businesses	161,768	174,709	188,686	203,781	220,083	237,690	256,705
Total From Both	289,523	312,685	337,700	364,716	393,893	425,405	459,437

For example, in the year 2002, it is estimated of the total 312,685 computers becoming obsolete in Missouri, 137,967 will come from households and 174,709 from businesses

Graph G9: Missouri: Comparison of obsolete televisions that are reused or recycled to those that are not.



	2001	2002	2003	2004	2005	2006	2007
Total Obsolete	267,181	288,556	311,640	367,169	396,542	428,266	462,527
Not Reused Recycled	240,463	259,700	280,476	330,452	356,888	385,439	416,274
Reused/Recycled	26,718	28,856	31,164	36,717	39,654	42,827	46,253

For example, in the year 2002, it is estimated that approximately 288,556 TV's will become obsolete in Missouri, and of those, approximately 28,856 will be recycled or reused and 259,700 won't

H. Missouri Estimates:

This section reports projections for the combined amount of obsolete computer electronics and televisions generated in Missouri from 2001-2007. What Missouri citizens say they will do with the targeted electronics that become obsolete, based on past methods of management and preferred methods of management, is also reported. These projections were determined by utilizing national data from reputable and informed sources, and then either prorating Missouri's share based on demographics, or by applying the results of the household and business surveys. Estimates and projections do not take into account future national or state strategies or programs for better electronics management and product stewardship.

Summary of Findings:

•It is estimated that a total of 15.5 million units of combined computer electronics and televisions will become obsolete in Missouri from 2001-2007. This equals 436,000 tons.

•By prorating the national statistics provided by NSC to Missouri demographics, it is estimated that of the total 15.5 million obsolete electronics generated between 2001-2007, only 2 million will be recycled, and 13.5 million will be stored or thrown away.

•If the cumulative total of targeted obsolete electronics generated from 2001-2007 are managed based on what Missouri households and businesses report in the surveys as the ***best methods*** for management:

- 5.3 million combined computer electronics and televisions (149,000 tons) donated;
- 3.1 million combined computer electronics and televisions (86,000 tons) thrown away;
- 2.8 million combined computer electronics and televisions (78,000 tons) collected by reuse or recycling companies;
- 4.3 million combined computer electronics and televisions (123,000 tons) either sold, given away, traded or stored.

•If the cumulative total of targeted obsolete electronics generated from 2001-2007 are managed based on what Missouri households and businesses report in the surveys as what they ***had actually done in the past***, future projections are:

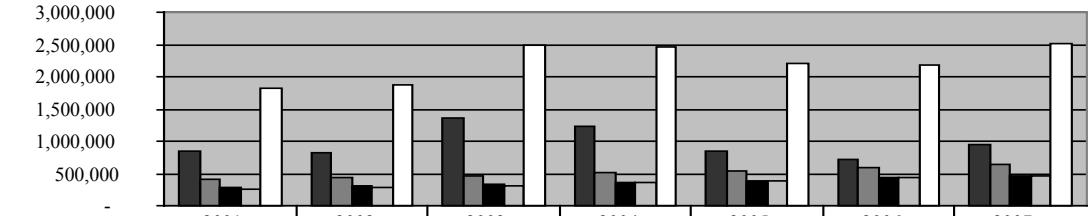
- 3.8 million combined computer electronics and televisions (107,000 tons) donated
- 4 million combined computer electronics and televisions (110,000 tons) being thrown away;
- 3 million combined computer electronics and televisions (86,000 tons) being collected by reuse or recycling companies;
- 4.7 million combined computer electronics and televisions (133,000 tons) either sold, given away, traded or stored.

•Just for the year 2002, 1.9 million combined computer electronics and televisions will become obsolete. Based on what Missouri households and businesses ***have done in the past*** with obsolete electronics, the year 2002 will see:

- 489,000 combined computer electronics and televisions (13,300 tons) thrown away;
- 468,000combined computer electronics and televisions (127,000 tons) donated;
- 2.8 million combined computer electronics and televisions (78,000 tons) collected by reuse or recycling companies;
- 4.3 million combined computer electronics and televisions (123,000 tons) either sold, given away, traded or stored.

Graph HI: Utilizing national statistics, Missouri's estimated total obsolete computer systems, CRT-monitors, peripherals and televisions, measured in units. It is estimated that a total of approximately 15 million individual units, (436,000 tons), of targeted obsolete electronics will require management during the years 2001 through 2007. Of that amount, between 30% and 47% will be CRT-monitors and televisions

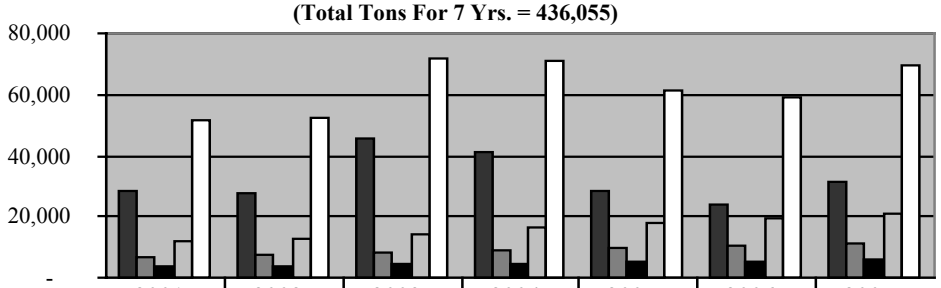
Missouri Estimated Combined Computers, CRT-Monitors, Peripherals, and CRT-TV's becoming obsolete from 2001-2007 (Total For 7 Yrs. = 15,495,442 Units)



	2001	2002	2003	2004	2005	2006	2007
Computers	852,619	832,687	1,355,811	1,220,474	856,470	718,216	941,794
CRT-Monitors	404,820	437,206	472,182	509,957	550,753	594,814	642,399
Peripherals	289,523	312,685	337,700	364,716	393,893	425,405	459,437
CRT-TV's	267,181	288,556	311,640	367,169	396,542	428,266	462,527
Total Per Year	1,814,143	1,871,133	2,477,334	2,462,316	2,197,658	2,166,701	2,506,157

For example, in 2002: 832,687 computers; 437,206 CRT's; 312,685 peripherals; and 288,556 CRT-TV's will become obsolete - totaling 1,871,133 units

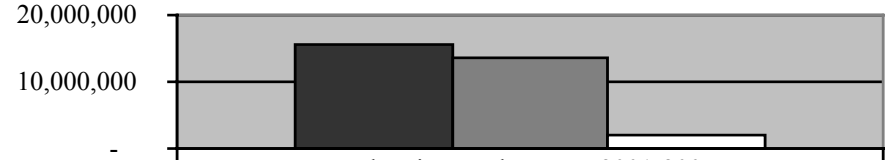
Graph H2: Utilizing national statistics, Missouri estimated total obsolete computer systems, CRT-monitors, peripherals and televisions, measured in tons.



	2001	2002	2003	2004	2005	2006	2007
Computers	28,563	27,895	45,420	40,886	28,692	24,060	31,550
CRT-Monitors	7,084	7,651	8,263	8,924	9,638	10,409	11,242
Peripherals	3,619	3,909	4,221	4,559	4,924	5,318	5,743
CRT-TV's	12,023	12,985	14,024	16,523	17,844	19,272	20,814
Total For Year	51,289	52,440	71,928	70,892	61,098	59,059	69,349

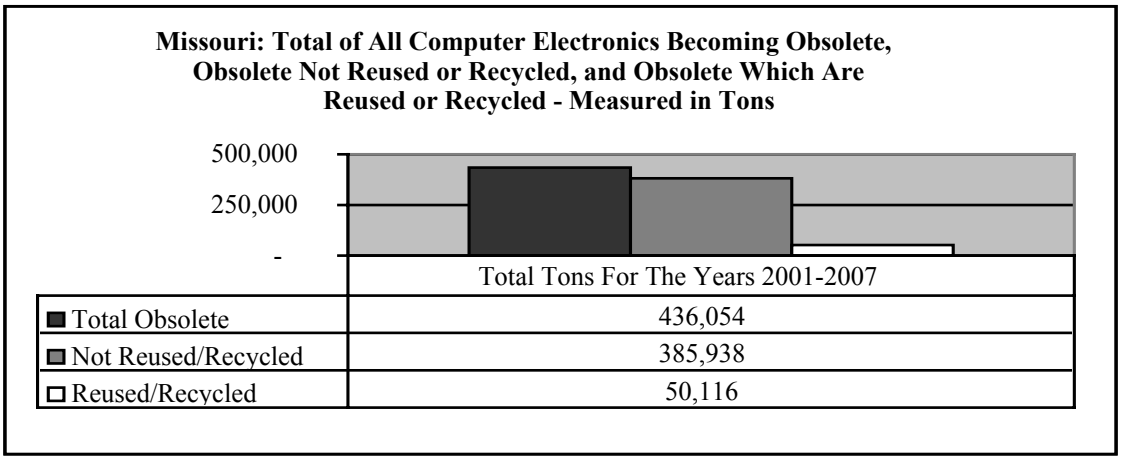
For example, in 2002: 27,895 tons of computers; 7,651 tons of CRT's; 3,909 tons of peripherals; and 12,985 tons of TV's will become obsolete - totaling 52,440 tons

Graph H3: Utilizing national statistics, an estimated total of all Missouri computer electronics becoming obsolete, obsolete not reused or recycled, and obsolete which are reused or recycled, measured in units. As stated in the methodology section, these projections are based on modified National Safety Council's Baseline Report Table 6 statistics, which estimate the total amount recycled (defined as combining recycler and third party organizations) to historical shipment data. Of the total 15 million units becoming obsolete, this method of analysis predicts that only 13% will be recycled or handled by third party organizations. A breakdown by product type can be found in Section G.

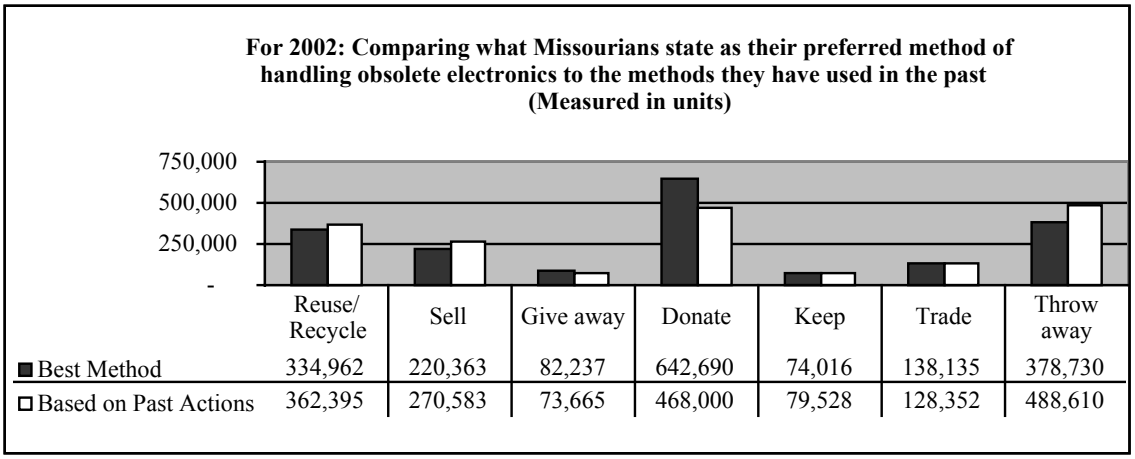


	Total Units For the Years 2001-2007
Total Obsolete	15,495,441
Not Reused Recycled	13,501,169
Reused/Recycled	1,994,272

Graph H4: Utilizing national statistics, an estimated total of all Missouri computer electronics becoming obsolete, obsolete not reused or recycled, and obsolete which are reused or recycled, measured in tons.

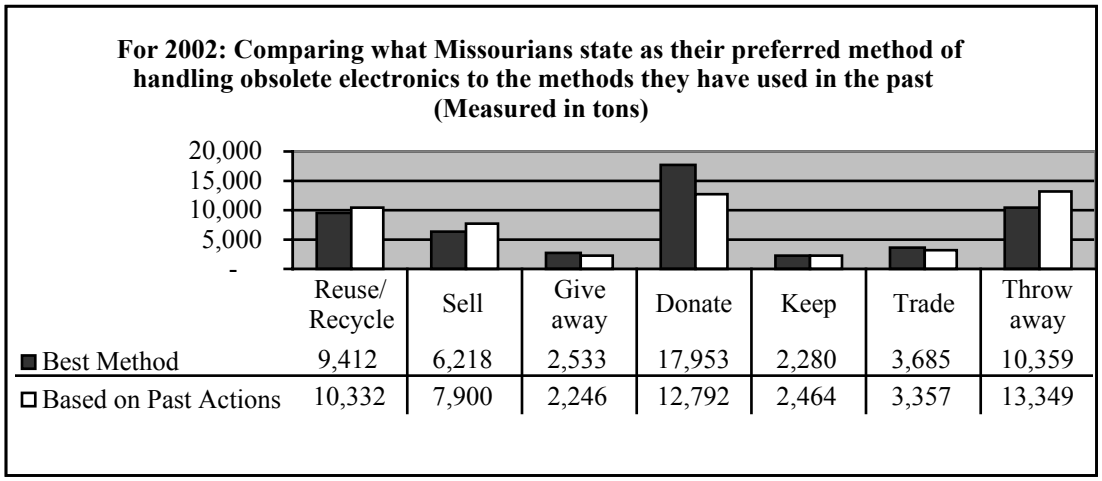


Graph H5: An estimate of what Missourians will do with the targeted electronics that become obsolete **in the year 2002**, measured in units. The data and how the vast amounts of targeted electronics becoming obsolete is now evaluated based on both: 1) what Missouri households and businesses report in the surveys to be the ***best methods*** for management; 2) what Missouri households and businesses report in the surveys as what they ***had actually done in the past*** with obsolete electronics. For example, if the obsolete targeted electronics are handled consistent with "Best Method" preferences, 643 thousand units will be donated to charitable organizations for the year 2002. But, if managed based on reported "Past Actions", only 468.000 units will be donated during that same time period.



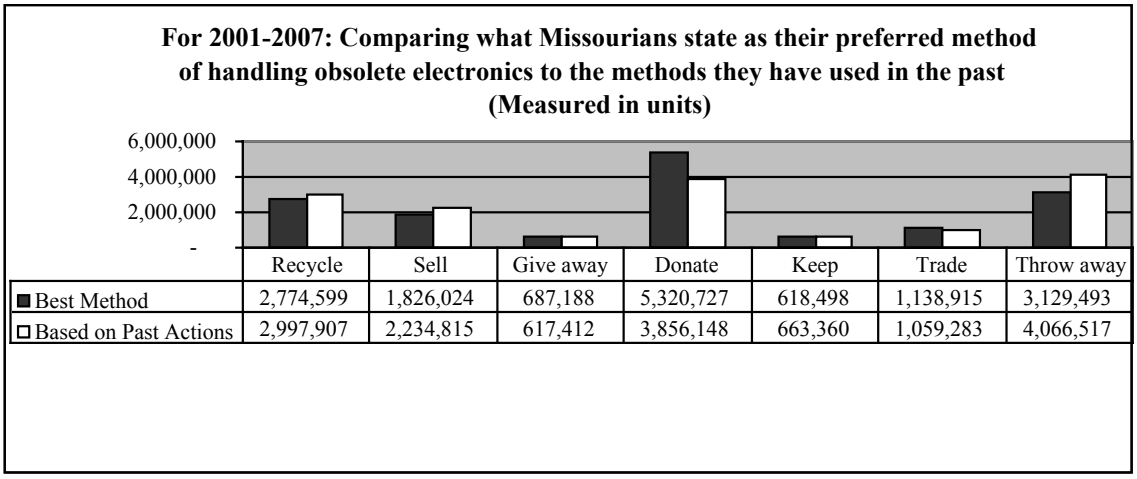
	Reuse/ Recycle	Sell	Give away	Donate	Keep	Trade	Throw away
Best Method	334,962	220,363	82,237	642,690	74,016	138,135	378,730
Based on Past Actions	362,395	270,583	73,665	468,000	79,528	128,352	488,610

Graph H6: An estimate of what Missourians will do with the targeted computer electronics that become obsolete in the year 2002, measured in tons.



	Reuse/ Recycle	Sell	Give away	Donate	Keep	Trade	Throw away
Best Method	9,412	6,218	2,533	17,953	2,280	3,685	10,359
Based on Past Actions	10,332	7,900	2,246	12,792	2,464	3,357	13,349

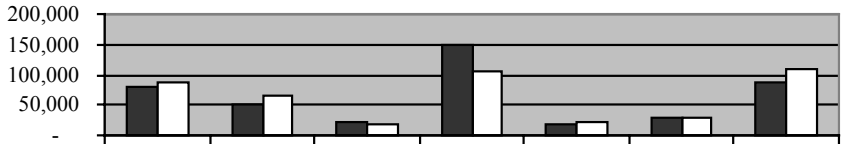
Graph H7: An estimate of what Missourians will do with the targeted electronics that become obsolete **in the years 2001-2007**, measured in units. This graph and Graph H8 report data similar to H5 and H6, but for the cumulative amounts of targeted obsolete electronics generated during the years 2001 through 2007.



	Recycle	Sell	Give away	Donate	Keep	Trade	Throw away
Best Method	2,774,599	1,826,024	687,188	5,320,727	618,498	1,138,915	3,129,493
Based on Past Actions	2,997,907	2,234,815	617,412	3,856,148	663,360	1,059,283	4,066,517

Graph H8: An estimated total of what Missourians will do with the targeted electronics that become obsolete between the years 2001-2007, measured in tons.

For 2001-2007: Comparing what Missourians state as their preferred method of handling obsolete electronics to the methods they have used in the past (Measured in tons)



	Reuse/ Recycle	Sell	Give away	Donate	Keep	Trade	Throw away
Best Method	78,296	51,749	21,318	149,220	19,187	30,434	85,851
Based on Past Actions	85,779	65,443	18,980	107,203	20,689	27,765	110,196

I. Surveys with Missouri Solid Waste Management District Planners.

The Missouri Department of Natural Resources Solid Waste Management Program (DNR SWMP) works closely with Missouri's 20 Solid Waste Management Districts and their Planners to propose regional solutions to waste management problems. The District Planners are viewed as an important contact for gauging current available activities and resources throughout Missouri for obsolete electronics management. Each of the 20 District Planners were emailed a summary of the project, and a brief six-question survey. Of the 20 Planners, 9 responded to the initial email or to a follow up phone call.

Summary of Findings:

•Of those District Planners responding, most view the management of obsolete electronics as a valid concern, and most are acutely aware of the obstacles to overcome when contemplating obsolete electronics management.

•Due to a variety of reasons, including money and other waste management concerns, not all District Planners can place the issue as priority.

•Most District Planners report a lack of available solutions and resources for correct electronics management.

•Donating older working computer electronics to nonprofit organizations is the most commonly sited management solution.

Survey questions and responses

Question #1: If asked, what advice would you give an individual or a business wanting to dispose of an older working computer? What if the items in question were 10 non-working monitors - what would you tell them to do?

•If they are replacing these items, I would suggest they arrange with the seller to accept these older items and let the manufacturer be responsible for disposal or reuse.

•I don’t really keep up on this issue and I am not sure what the options are.

•We have some computer repair places that take in older working computers from time to time. Also, we have developed limited use for them in computer repair training classes in our region.

•Due to our close proximity to Kansas City, I suggest that the individual take their items to the Surplus Exchange. Other than that, there are no readily available options.

•Presently we have no appropriate disposal options in Region R. Donate to organization such as OCAC, Habitat for Humanity, etc. For non-working some organizations, such as the Habitat for Humanity "ReStore" in Springfield will take them.

•Churches and local organizations, Scouts, 4-H clubs, etc. are approached about receiving older working computers. The computers are often great word processors and work for church bulletins and meeting notices.

•Non-working monitors pose a problem. In the past the District has held electronic collections and the material was delivered to Surplus Exchange. Due to budget restraints and the increasing cost associated with electronic recycling, the District will not be conducting an electronic collection for 2001. Callers are encouraged to hold the monitors until 2002 when an electronic collection will be examined.

•Schools and a couple places that take used. I'd tell them to throw the monitors away.

•I'd tell them to ship the electronics to Kansas City or St. Louis…. To one of the places there that handles them.

Question #2: Have you read the grant summary and the objectives? Any opinions or suggestions?

•Yes. Not really.

•Doesn't seem to be as big of a concern as everyone is saying.

•None

•No opinions or suggestions.

•Yes read it, no opinions.

•Yes. Looks good, this is needed.

•Definitely a concern for our District. Electronic collections held in 2000 were well attended and appreciated by all that participated. I also would say that similar concerns are shared in other Districts.

•Yes. State needs to decide if this is a priority and if so, ban the stuff.

•Yes. There are not enough options based on how large you say the problem is. Remember that for the less populated areas, this isn't as much of a priority. Good luck.

Question #3: Do you view this topic as a valid concern for your District, or the State of Missouri?

•I think it's valid for everyone to be concerned with our "throw away" society. We must require product stewardship in everything made and sold to insure that the disposal costs are reflected in the purchase price.

•No and no.

•Absolutely, in both cases.

•Valid, yes. High priority? probably not. We have enough trouble getting people to recycle the obvious candidates, much less something like computers. However, I think that this is something that is not being approached by our district and others that could become a priority.

•Yes

•Yes. Doesn't seem to be a huge problem in my district, but it probably is for larger more populated districts.

•Yes. Same as my answer for #2: There are not enough options based on how large you say the problem is. Remember that for the less populated areas, this isn't as much of a priority. Good luck.

Question #4: Would you like more information on the topic of obsolete and end of life electronics? If so, is there specific information you would like?

•I believe I'm well informed on the subject, but I bet you'd like to keep everyone updated.

•Any information would be welcome. Information on promising disposal or use practices would be useful.

•Only if it seems the issues are important for the state.

•We are inundated with information now. It would have to be specific and relevant. A targeted approach, ie, how to dispose of a used monitor, etc. would be something that we could use to inform our citizens.

•Our regional planning commission is in the process of donating useable equipment to viable non-profits.

•Yes, any available.

•Information in the form of where to recycle would be very helpful. With decreasing funding it is hard to accommodate all the needs of the district residents.

•Yes. Most interested in collection programs and hazardous materials.

•Yes.

Question #5: Are there any businesses or programs in your District, which collect, process or sell older, used electronics? If so, could you list them please.

•I don't think we have any.

•Surplus Exchange in Kansas City.

•None, currently.

•None that I am aware of.

•None that are known of presently.

•Habitat for Humanity ReStore, Springfield.

•Not to my knowledge, although I have been told there is a business in Cameron. I have been unable to get a name or number.

•I believe a recycler just started taking electronic equipment – don't know who they are.

•Some computer stores that sell used. Is that what you mean?

Question #6: What are the obstacles for your District in participating in a program, which would collect and process obsolete electronics? Amount is not significant enough to worry about? Money? Transportation? Interest? Time? What else?

•None other than all the above.

•No response.

•Money.

•I don't know if the amount is significant or not. I do believe that transportation and cost would be an issue. Also, having a drop-off site or collection route would be key. Of course, to have those, it must be able to pay the expenses of the hauler.

•Transportation

•No response

•Money.

•Costs. With staff time, advertisement, transportation and disposal costs it just doesn't fit into the budget. The District Council would have to vote to eliminate another collection to budget an electronic collection. With the popularity of HHW and appliance collections I don't see either of those collections being dropped to allow the budget to hold an electronic collection.

•Priorities and money. Seems that no one has the time or money for periodic collections or a permanent facility. Maybe the money that went for this study should have gone for collections (?) (ha ha)

•It is just too easy to throw computers away. No one wants to dedicate money to this right now.

VII. Collection Programs

The principal objective for this project is to provide information that will help guide the state of Missouri in making informed decisions regarding the most efficient and fiscally responsible means of supporting the management of obsolete and otherwise unused electronics. The Missouri Department of Natural Resources Solid Waste Management Program's (SWMP), history of supporting and funding electronics reuse and recycling initiatives, and their involvement as a stakeholder in the NEPSI dialogue are examples of the SWMP's dedication to making this situation better.

As SWMP proceeds, the evaluation of electronic collection programs and facility-based obsolete electronics initiatives will assist in making future decisions regarding how they can best influence, encourage and support obsolete electronics management in the state of Missouri. The proceeding sections provide general information and financial data pertaining to collection models and a permanent facility model.

A. Planning

Strategic-business planning is crucial to the consideration and implementation of any collection or facility reuse or recycling model. Such planning will help identify a community's specific needs, the potential for materials and end-markets, and program costs. Developing a strategic business plan will include:

i. Developing a Mission Statement:

- Factors motivating the start-up of many obsolete electronic collection programs include: a state mandate prohibiting the disposal of certain electronics; to meet a state's recycling goals; as a reaction to the lack of landfill capacity; as a means of benefiting charitable communities by providing reusable electronics.

- The mission statement is a clear a concise statement affirming the programs services and/or products offered, and how they will be offered. The mission statement is not the starting point, but rather the end result of an extensive and thorough understanding of the potential for customers, how customers want the program made available to them, types and quantities of materials available, and a general understanding of the industry.

ii. Conducting a Market Analysis to determine targeted materials, targeted participants, and end-markets:

- Ultimately, the program will want to define the type of electronics it will target, how it will process them (reuse, recycle, both) and the best way to deliver the services and products to the community.

- A market analysis will begin to measure the local climate's potential for such an endeavor by evaluating the present situation, including:

- Are there already businesses or programs, which handle obsolete electronics, if so:
  - Is there part of the market (either customers or type of electronics) that current efforts are missing?
  - Is there a potential for new programs to fill the missing niche?
  - Is there a potential for mutually beneficial community partnerships among existing and new efforts, which could maximize efforts and minimize costs?

- An analysis to determine the types and amount of electronic equipment potentially available to the programs:
  - As there are many types of obsolete electronics, defining which types will be collected is important in designing and determining costs for the program.
  - The type of electronics collected and how they are processed, (reuse? recycling? both?), should also reflect the mission and goals of the program.

- An analysis to determine contributors of equipment:
  - Based on the type of electronics the program targets to collect and process, who may contribute materials?
    - Residences
    - Businesses
    - Municipalities
    - Schools
    - Other institutions such as hospitals

- An analysis to determine end-markets for the contributed equipment:
  - Based on the type of electronics the program targets to collect and process, what are the best end-markets and revenue potential?
    - Reusable sales to general public?
    - Reusable donations or sales to charities?
    - Recycling companies that, (based on type of electronics):
      - Charge to accept all equipment
      - Charge for some, pay for some, breakeven for some

  - Also, planning for and costing out the entire distribution system, from acquiring and collecting the electronics, to sorting or repairing them, to making them available to charities or delivering them to other end-markets. In essence, how will the program

collect electronics, how will electronics be processed, and how will it get them to end-markets. What does the entire flow look like and how much will it cost?

- The analysis of both markets, contributors of electronics and customer/end-markets, should also include an evaluation of how each of these customer bases wants the program "delivered". Identify strategies, reasonable conveniences, and added value marketing, which will attract and maintain customers/end-markets, including:
    - Best location(s) for a facility or drop-offs.
    - Determining a reasonable collection fee, if any:
        - Have fees been paid in the past?
        - Can the program afford not to charge?
        - Is there an accounting system currently in place to accept fees and dedicate them to the program's cost?
        - Based on the programs sponsorship, are there policy reasons fees cannot be charged?
        - If fees are charged, are they enough to cover all expenses including fees charged by recycling companies?
    - Hours and days of operation, or best days for drop-off or curbside pickup.
    - Special arrangements for larger volumes of materials from businesses such as direct vendor pickup.
    - Especially if the program is targeting reusable computers, business customers may have special security or liability concerns that must be fulfilled, such as hard drive erasure or hazardous waste disposal documentation. If the collection of reusable computer systems is a targeted program, relationships with IT or asset recovery personnel at larger companies is very helpful, along with the understanding of their specific requirements.

- In addition, based on the type of electronics targeted and how they are processed certain requirements might be necessary, including:
    - Federal requirements, such as EPA's proposed Universal Waste Rule for CRT's.
    - State requirements.
    - Local considerations, such as permits and zoning restrictions.

iii. A Marketing Plan:

- Depending on the type of program and electronics collected, two marketing plans may be required. If the program is only concerned with the collection of electronics, and utilizes a recycling/reuse company to process the materials, a marketing plan to attract and maintain equipment contributors or donors is only required. If the program conducts collections and also donates or sells equipment, most likely a marketing plan to attract buying customers is also required.

- The marketing plan is based on information obtained in the market analysis phase, and will include:
    - Ongoing consumer research to continually evaluate the best services to offer, and how those services are delivered:
        - Conducting surveys at the facility or location of the special event.
        - Surveying other state or national electronics programs to see how they are setting up and managing programs.
        - Utilizing a website for general information, including program feedback.

    - Use of outreach strategies such as:
        - Free and timely public relations as available.
        - Effective and inexpensive advertising.

    - Publicity basics, such as making sure all marketing information includes:
        - When and where the collection or facility is.
        - What equipment is and isn't accepted.
        - Benefits to those participating.
        - Narrative that is short, positive, easy to read, and to the point.
        - If required, short explanation regarding fees.
        - Contact information.

    - Estimating and budgeting for advertising and other marketing expenses.

iv. Site Selection/Location:

- Including:
    - Accessibility and desirability to all customers, staff and volunteers.

    - Functionality requirements for the type of program:

- If a drop-off site, capacity to handle a lines of cars and unloading.
- Cover or storage for materials dropped-off.
- A loading dock and/or drive-in door if facility based.
- Enough room for storage of equipment and supplies, and space for triage of materials.
- Enough room for reuse or recycling processing.
- Enough room for offices or administrative needs.
- Enough room for trash.
- Space for customers, staff and volunteers to park.
- Enough room for tractor trailers if required.

o Are there costs to rent or own, and maintain location?

o Zoning requirements

v. Determining Staff Requirements:

- The type of program put in place and the services and/or products offered determines staffing requirements. A facility-based program, incorporating repair and reuse of electronics, will require different staff expertise than an ongoing drop-off or special events program utilizing a recycling vendor. For job responsibilities and suggested staff for ongoing and special collection events, please refer to the NERC training manual:http://www.nerc.org/adobe/survey/index.html

- Staff and costs for a typical drop-off program and a facility-based program are provided later in this section.

- Volunteers can play a key role in all types of electronics collection and processing models. If not properly trained and prepared, they can also become a liability to the program. At a minimum, volunteers should be given a brief training on the history of computer recycling and the particular program they are participating in; the hazardous components contained in electronics; if there is a collection cost involved and why; and general customer service techniques. In addition, volunteers should be suited for the job they are assigned, and if lifting is required, demonstration should be provided.

vi. A Budget Analysis:

- The market analysis will help determine the best, most efficient program to serve the needs of a particular community. The budget analysis will examine the resources required to start-up and operate the program. Ultimately, it has to be determined if the program can deliver its mission and accomplish its goals while remaining fiscally responsible. Depending on the program and its

business entity, fiscal responsibility can include the use of primarily government and/or grant funds, earned income, or both. No matter where income or revenues come from, they have to be measured against expenses and program effectiveness.

- A budget or cash-flow analysis will provide financial projections which will:
    - Estimate total expenses and income.
    - Project at what point in time dollars are needed, especially start-up funds.
    - Identify what additional financial resources may be required.

vii. Implementation Schedule:

- Starting and maintaining any program model in a systematic way will minimize unknown factors and help see each individual effort in relationship to the entire process. This is no more then identifying and time-lining the tasks to be accomplished, and the personnel responsible for implementation. This type of sequential planning will also help "schedule" what resources are required when. For example, special equipment such as pallet jacks should not be ordered until storage can be provided, or ordering of advertising materials timed with the dates of the events.

viii. Community Development:

- Obsolete electronics management programs can be more than just "keeping stuff" out of the landfill. Numerous programs across the country, including Kansas City's own Surplus Exchange and the St. Louis' Goodwill Industries' program, are examples of how electronics programs can offer educational, job training, and vocational training opportunities to a variety of community constituents.

- Surplus Exchange's Mission Statement reads, "To benefit Not-For-Profit Organizations by providing them with refurbished and new electronics, furniture, materials and other equipment; to preserve the environment by keeping unwanted and obsolete business equipment out of the waste stream; ***and to utilize the resources and expertise from these operations to provide education and human service programs to the general community***". This third component of the mission statement, has been realized by the organization, and demonstrates the huge potential the industry of obsolete electronics holds for community development.

- Many programs collect and make computer electronics available for charities to use. Unfortunately, some businesses, donating to these programs, view the charitable community as a dumping

ground for their discards, offering broken or incomplete systems. As a rule of thumb, a donation should not encumber or burden the recipient. Other programs, such as Massachusetts' relationship with Goodwill Industries, are actually partnering with charitable organizations and working collaboratively with them in the collection and processing of targeted electronics. This results in job and vocational training opportunities, which translates into economic development and a stronger community.

B. Collection Models

Learning from past and existing collection models will help Missouri identify: 1) how to market to potential customers; 2) the types and quantities of materials most commonly collected; 3) matching materials collected and end-markets; 4) anticipated number of attendees; 5) associated costs; and 6) general understanding of the operations for this type of electronics management.

Collection models are a common obsolete electronics management strategy. Typically, collection models fall into three main categories: Ongoing, Curbside, and Special Event. Further categorization would represent the sponsoring entity or partnerships formed, such as government, not-for-profit, and some cases for-profit. Although numerous collection programs were reviewed, this report utilized information from four sources outside the state of Missouri, and then compared this data to two collection programs held within Missouri.

Sources for information on collection models outside the state of Missouri are the:

- "Analysis Of Five Community Consumer/Residential Collections Of End-Of-Life And Electrical Equipment." This report studied five different collection models across the country occurring from 1996 to 1998.

- A May 1999 study conducted by Materials for the Future Foundation titled, "End-Of-Life Consumer Electronic and Electrical Products In The Alameda County And City of San Francisco Municipal Waste Streams: An Investigation Of Models For Community Economic Development.

- "Recycling Used Electronics – Report on Minnesota's Demonstration Project." The Project reports the results of a 1999-2000 partnership between Minnesota's Office of Environmental Assistance, Minnesota communities and industry partners: Sony Electronics, Waste Management-Asset Recovery Group, Panasonic and the American Plastics Council.

- The Northeast Recycling Council, Inc. (NERC) 2001 study and manual, "Setting Up & Operating Electronics Recycling/Reuse Programs: *A Manual for Municipalities & Counties".* The NERC report is a very good summary of numerous collection programs across the country, (including some of those reference above), and is also a manual for effectively setting-up and operating electronics reuse and recycling programs. The NERC project is relied upon quite often in this section, as it identified approximately five hundred residential electronics collection programs in the United States conducted from 1998 through August 2001, and collected survey responses from 176 of these. No programs conducted in Missouri responded to the NERC survey. The entire project can be found at: http://www.nerc.org/adobe/survey/index.html

Programs reviewed in the state of Missouri are:

- The Saint Louis County Department of Health's (DOH) Consumer Electronics Product Stewardship Program. The first event was held in September 2001 and the second in April 2002.

- The Mid-America Regional Council's (MARC) Solid Waste Management Districts Electronics Events Program. A three-event program held in November of 2001, for the purpose of collecting computers, related peripherals and non-console televisions for reuse and recycling, and evaluating associated costs.

C. NERC Survey Results

With permission from The Northeast Recycling Council, Inc. (NERC), a summary of their survey results is provided. Hopefully, this information will be helpful for any Missouri government or community considering starting-up a new or enhancing an existing electronics collection program:

1. Percentage of programs by collection-model type:
   - 47% of the programs provide ongoing drop-offs.
   - 45% are special events.
   - 8% are curbside.

2. Targeted Participants:
   - All but one of the programs reported residents as the primary targeted participant.
   - Most programs allow small businesses and schools to participate, with only 24% of the programs surveyed restricting participation to residents only.
   - Some programs allow small businesses to participate only under certain conditions, such as contacting the program first and listing the materials they plan to dispose of, paying a higher user fee, or prepackaging their materials for easier collection.

3. Average number of households participating yearly by collection-model type:
    - Ongoing drop-offs: 1,019 households per year (the highest participation rate).
    - Curbside: 732 households per year.
    - Special event: 463 per year.
    - Across the board, approximately 1% of households participate yearly in any electronics collection program.

4. Most common types of materials accepted:
    - 100% of all collection-model types collect computer monitors.
    - 84% collect computer hardware.
    - 83% collect computer peripherals.
    - 77% collect televisions.
    - 67% collect VCR's.
    - 46% collect other types (assumed to be a variety of household consumer electronics).
    - When broken out by collection-model type, computer monitors are still the most common electronics collected, with computer hardware or televisions being second. This indicates that the collection-model type, with all else being equal, most likely, does not affect the types of materials collected.

5. Amounts of electronic materials collected:
    - 19 of the programs surveyed were able to provide the data required to determine the average amount of materials, by weight, each vehicle attending dropped off. The 19 programs were not identified by collection-model type.
    - A combined total of 1,060,478 pounds of electronics were collected for the 19 events, or an average of 55,815 pounds per event, (high was 140,000 pounds for one event; and low was 11,168 for one event).
    - The 19 events had a combined total of 9,008 vehicles, or an average of 474 vehicles per event, (high was 1,035 vehicles for one event; and low was 100 for one event).
    - The average weight of electronics dropped off per vehicle is 118 pounds, (high average was 208 pounds per vehicle; and low was 70 pounds per vehicle).

6. Annual average per capita collection rate:
    - All collection-model programs combined, averaged 1.9 pounds of electronics per capita annually. This number should be considered a basic estimation, as many of the programs are new or either one-time events, not reflecting the potential for amounts collected over a period of time.

- Massachusetts, which has operated numerous programs for approximately two years, reports the average weight to be 1.65 per capita annually.

7. Fees paid to recyclers for materials collected:
    - Approximately 12% of the respondents report that the fees paid to recyclers are for CRT's only, and the balance of the electronics are taken by the recyclers at no cost.
    - In discussions with program managers, this researcher found that the costs reported at the time of the NERC survey have increased from 10% to 25%, due in general, to the lower revenues recyclers now receive for the materials they process, and specifically, to the increasingly higher costs associated with handling CRT's. These costs are passed on to the programs conducting the events.
    - NERC reports that there are geographic patterns for the fees being charged by recyclers for processing the materials collected, due to market conditions and transportation costs.
    - At the time of the NERC survey, the collection programs responding to the survey from the Mid-West report paying the highest recycling fees, averaging $388 per ton. This is interesting in that of the 79 recycling companies surveyed in the National Safety Council's EPR2 Baseline Report, 26% were located in the Mid-West. This actually reinforces NERC's assumption that higher fees are paid due to market conditions and transportation costs. Most likely, it is not that there are fewer recycling companies collecting electronics in the Mid-West, rather, it is that there are fewer end-markets in this region, resulting in higher transportation costs to transport the materials to more suitable market conditions. This is a cost considered by recyclers and passed on to the programs.

8. Fees paid by participants:
    - The NERC study reports that with all collection-model types dealing *just with residences*, 50% charge a fee and 50% do not. Of all collection-model types dealing with *residences and businesses*, 47% do not charge either businesses or residences a fee, 45% charge both residences and businesses a fee, and 8% charge only businesses.
    - It is also noted that the fees charged to businesses are often higher than those charged to residences.
    - When a fee is charged, generally it is for CRT-monitors and televisions. The range is consistent across the country, averaging $5 for each monitor, with a low fee of $3 and a high of $20.
    - Collection models, which charge per item or per system, charge between $1- $15.

9. Program management and location:
    - By far, county, district and municipal governments manage the majority of collection programs, with 91% managing ongoing models and 70% managing special events.
    - Combined, electronics recyclers, solid waste haulers, charities, electronics manufactures, retailers and volunteer groups manage the balance, at 18%.
    - For all collection-model types, 39% of the programs are held at municipal recycling centers, 23% at DPW yards, 14% at curbside, 13% at various parking lots and other sites. When evaluating just ongoing collection programs, 60% are conducted at municipal recycling centers.

10. Program frequency:
    - Programs appear to be very accessible. On average, curbside programs offer collections one day a week, ongoing programs are open an average of almost 4 days per week, and special events occur an average of three days per year.

11. Cost to set up programs:
    - Program cost will include, but are not limited to: staff, coordinating volunteers, marketing and advertising, equipment and supplies, refreshments and permits.
    - The NERC study reports the average cost to be $3,086. This is a case where the "average" should just be a consideration. Costs are influenced on the collection-model type, population served, and tenure of the program. Programs, which utilize an existing reuse or recycling infrastructure such as an ongoing general recycling center, tend to be less expensive. New and/or sporadic programs tend to incur more expenses. Special event models tend to be more expensive and curbside, if ongoing, are less expensive.
    - In total, 80% of the respondents reported setting up their programs for under $5,000.

12. Average tons collected per year and operating cost per ton, per year:
    - Based the responses to the survey, (which NERC acknowledges maybe influenced by the fact that 12 or the 14 curbside respondents were from Massachusetts), curbside programs average the most tons per year, while incurring the least amount of cost.
    - Breakdown:
        - Special events — 23 tons per year — $464 per ton per yr.
        - Ongoing — 56 tons per year — $448 per ton per yr.
        - Curbside — 71 tons per year — $304 per ton per yr.
        - All programs — 50 tons per year — $374 per ton per yr.

13. Amounts of materials being reused:
    - In general reuse is not a significant part of these collection models, and/or the program's management does not know the fate of materials collected.
    - Although 68% of the respondents say some materials are recaptured for reuse, fifty-seven percent report the amount is less than 15%, nineteen percent report 15%-25%, nine percent report25%-50%, fifteen percent report more than 50%, and twenty-three percent don't know.

14. Summary of all NERC data:
    - Curbside collection programs are the most cost effective when comparing cost per ton to collect and process to expenses.
    - The most common type of recycling collection program (reporting to NERC) is an ongoing collection model.
    - Outside of Massachusetts, only 64% of the programs are collecting televisions. This researcher also found that CRT-monitors and CRT-television are identified as the materials most affecting expenses, and the materials most identified by program managers as problematic in general.
    - 25% of the all programs cannot identify the ultimate fate or end-market for the electronics they collect.

D. Electronic Collection Programs in Missouri

This study was identified six obsolete and end-of-life electronics collection programs in the state of Missouri conducted during the past four years. Of those, only two recent programs focused on electronics only, and documented their results. The other four initiatives, although reporting some degree of success, were unable to provide quantitative results for this report as their programs either collected electronic materials along with other bulky items or white goods, did not separate and measure just electronic items collected, or did not track expenses or the number of participants.

The two recent electronic collection models held in the state of Missouri were:

1. Saint Louis County Department of Health's Waste Management Branch Consumer Electronics Product Stewardship Program (DOH). DOH's Waste Management Branch is charged with promoting proper waste management and increased waste diversion. Funding for programs come from landfill surcharges.

   As part of its' solid waste management strategic plan, DOH has set the goal of developing a sustainable consumer electronics program in 3-5 years. The collection of consumer electronics is a primary target for the Saint Louis County Municipal Recycling Grant Program. DOH is currently

evaluating approaches for expanding current collections, processing, and market outlets for reuse and recycling of consumer electronics.

In addition, DOH has fostered increased public awareness by publishing information on the proper management of consumer electronics in its recycling newsletter, distributed to over 135,000 households n unincorporated Saint Louis County. DOH staff maintains a list of recycling outlets for consumer electronics. As part of their future research and assessment efforts, DOH conducted an extensive public opinion survey in December 2001, to assess the volume of obsolete electronics, and to gauge residents' preference for collection options and willingness to pay to properly manage obsolete electronics. Final tabulation and analysis is forthcoming.

DOH funded and conducted their first collections program in September 2001 in University City, with the following results:

- The event targeted a wide range of consumer electronics including computers and their peripherals and parts, TV's, phones, stereo equipment, etc.
- The event was available to households only.
- The event was advertised through direct mail to 18,000 University City households.
- Approximately 330 participants dropped-off approximately 24,000 pounds, averaging 73 pounds per participant.
- Of the total materials collected, 293 items were either TV's or CRT-monitors.
- Participants were not charged a fee for dropping off equipment.
- The collected materials were shipped to a recycling vendor, United Recycling, outside Chicago.
- Total expenses, including staff, shipping costs and recycling fees was $17,853. DOH recognizes that their marketing expense of approximately $8,000 was extensive, but required for a first time event.
- Based on the information provided, cost to collect and process materials equaled 74¢ per pound or $1,480 per ton.
- The second program was conducted in April, and at the time of this report the results are not yet available.
- Survey results indicate that over 60% of participants prefer periodic drop-off events. Over half, 52% would pay between $1-$10 drops off fee.
- DOH staff reports that events involve a considerable amount of staff and financial resources for a minimal

impact on the waste stream. To improve program availability and sustainability, DOH needs to pursue more cost-effective and efficient alternatives.

2. The Mid-America Solid Waste Management District Electronics Collection Events. The MARC Solid Waste Management District (MARC) serves the local governments in Cass, Clay, Jackson, Platte and Ray Counties on the Missouri side of the Kansas City metropolitan area. MARC has demonstrated responsible and continued efforts supporting the proper management of obsolete and end-of-life electronics support since its inception in 1991. Electronics programs funded in the past have included:

    - A CRT-Monitor and Demanufacturing Project, focusing on the collection and processing of CRT-monitors.
    - An Electronics Demanufacturing and Recycling Project, focusing specifically on the collection and processing of obsolete computer related electronics.
    - A Cooperative District Solid Business Waste Reduction Project, focusing on obsolete electronics and other business equipment.
    - A Solid Business Waste Reduction Program, providing salaries for staff to collect and divert an additional 1,600 tons of unwanted electronics and business equipment from the local waste stream.

    Beyond the grant dollars provided to increase the amounts of electronics collected and made available for reuse and recycling in their region, the MARC staff has offered their expertise to organizations and businesses concerned with managing obsolete electronics.

    MARC and Surplus Exchange organized three consumer electronics recycling events for the bi-state Kansas City area, two events were held in Missouri and one in Kansas. The events were held during the month of November 2001. The events yielded the following results:

    - The events targeted computers, related peripherals, and non-console televisions.
    - Only residences were allowed to participate.
    - Due to the partnership with Surplus Exchange, collected materials were targeted for both reuse and recycling.
    - A total of $6,605 in fees were collected, based on the following fee schedule:
        - $12 for computer monitors.
        - 25¢ per pound for televisions.

    - No charge for CPU's and other computer components (scanners, printers, keyboards, software).
    - 25¢ per pound for other electronics upon approval.
- Host communities provided in-kind support in the form of site coordination.
- A total of 38,533 pounds of electronics were collected.
- There were a total of 491 participants.
- The average weight dropped-off per participant was 78 lbs.
- The materials were collected and processed by The Surplus Exchange. Surplus Exchange did not provide data describing the ultimate end-market for the materials collected. Based on their mission and daily activities, the researcher would estimate that by weight, 10%-20% was processed for reuse, and the balance, 80%-90% was shipped to a third party recycler.
- Volunteers were used at each of the events to help unload and triage electronics.
- The three events cost $11,055 to conduct (collection fees less expenses).
- The cost to collect and process materials equaled 29¢ per pound or $580 per ton.

MARC Electronics Events Breakdown of Materials by Weight:

Event	Computers - Monitors - Peripherals (lbs)	Televisions (lbs)	Other Electronics (lbs)	Total Pounds
November 3, 2001	4,120	1,984	-	6,104
November 10, 2001	5,984	2,461	394	8,839
November 17, 2001	18,602	4,356	632	23,590
TOTAL:	28,706	8,801	1,026	38,533

The MARC events also surveyed patrons at collection drop-off sites, with the following results reported:

- Over 90% said they would recycle electronics at a future event.
- Over 80% said they would be willing to pay a disposal fee.
- The mean distance patrons would be willing to travel to a permanent electronics recycling facility is 18 miles, (in the Kansas City Metro Area this equal approximately 20-30 minutes driving time)

- Newspaper articles followed by paid newspaper advertising were reported to be the best method to inform residents about the events.
- Missourians are willing to support the state's effort to keep electronics out of the landfills, and Government does not necessarily have to bear the cost alone.

E. Comparison of Missouri Collection Programs to NERC Study:

It is important to take into consideration that these comparisons are limited to the amount of data reported by respondents in the NERC survey, and the information provided regarding each of the Missouri programs. Equally important, is the awareness that other factors affect aspects of a program's results, including initial set-up costs if the program is brand new, and conversely, the longer a program is in place, the more it builds upon itself requiring less expenses to promote and operate. Other factors include population density, use of volunteers, fees charged by recyclers, and as Massachusetts has shown, the impact of legislation and regulation.

Chart III: Comparing Missouri Collection Events with NERC's Survey

	NERC	DOH	MARC
Targeted Participant	Only 24% restricted participation to residences	Residences only	Residences only
Materials Accepted	100% accept CRT's, TV's 84% accept hardware 83% accept peripherals 67% accept VCR's 46% other HH electronics	CRT's and televisions Computer electronics Phones Stereo equipment Other HH electronics	CRT's and televisions CPU's some peripherals. Discourage other HH electronics
Amounts Collected	Average 55,815 lbs. per event.	Approximately 24,000 lbs.	Approximately 29,000 for three events
Participants Per Event	Average 474 per event	330 participants	491 participants for three events
Amount Per Participant	Average 118 lbs. Low was 70 lbs. High was 208 lbs.	73 lbs. per participant	78 lbs. per participant
Fees Paid to Recyclers	Yes, mostly for CRT's	Yes, mostly for CRT's	TV's and CRT's

Fees Paid by Participants	50% of programs charge CRT's most commonly for Range from $3 to $20	No charge	$12 CRT's 25¢ lb TV's N/C CPU's & peripherals 25¢lb. other w/approval.
Cost Per Ton	$374 for all programs $464 for special events $448 for ongoing programs $304 for curbside	$1,480 per ton	$580 per ton
Program Costs	Average of $3,086 No breakdown by type 80% report set up is $5,000 or less	$17,853	Average of $3,685 per event

F. Estimating Collection Model Startup Costs:

There are three main types of collection models: ongoing, special event, and curbside. As stated previously, no two-collection programs are alike, as no two communities with their specific requirements and resources are alike. Conducting a strategic-business plan or feasibility study will assist each community in determining the best model to match its needs and determine the resources required.

With MARC's permission, the actual budget required for their events is provided here as a template for a first-time electronics collection event. Depending on the tenure of the program, and other factors such as fees charged to participants, fees charged by recyclers, and paid advertising required, these figures would vary from program to program.

Chart IV: MARC's Start-up Budget

Income:		
Collection fees	$6,605	
Expenses:		
Personnel	**Funded**	**In-Kind**
MARC Personnel*		
• Project Coordinator (150 hours)	$3,487	
• District Staff planning support (21 hrs.)	$488	
• On-site district staff support (37 hrs.)	$860	$2,448
• Other volunteers		
Subtotal All Personnel:	$7,283	

Professional Services		
Surplus Exchange**	$195	$1,275
Asset Recovery Services (recycling fee)	$4,663	
Freight charges	$550	
Subtotal All Professional Services:	$6,683	
Promotion		
Advertisements	$1,942	
Equipment and Supplies		
Tent Rental	$508	$169
Signage	$55	
Scale Rental	$300	
Food	$309	
Miscellaneous	$61	
Portable Restrooms		$350
Subtotal All Equipment and Supplies:	$1,752	
Income from Collection Fees		**$6,605**
All Expenses (including In-Kind)		**$17,660**
Net Profit/Loss		**-$11,055**

*MARC provided all hours reported for MARC personnel, but estimated salaries for the positions were determined utilizing MARC's 2001 Salary and Fringe Benefits Survey. Fringe benefits of 34.4% are based of DNR's maximum rate allowed

**** MARC provided all hours reported for Surplus Exchange, but estimated salaries, including benefits are estimated at the rate of $25 per hour for planning personnel, and $15 for on-site personnel.

***The events incurred an additional $1,612 of promotional expenses related to giveaways, a reception, and gifts, which are atypical and were not included in this budget.

Include all the caveats.

G. Collection Programs Summary:

Currently, collection-models are a common strategy for "curbing" the flow of obsolete electronics into the waste stream. Although most programs are well

intended and produce results, the cost per ton is very high and the process usually reported as being taxing on the entity managing the event or program. The burden for this type of strategy, as is the case with many obsolete electronics' management strategies, falls on municipalities and other governments. Although, program managers are skilled and understand the issues, the burden needs to be shared and the expenses minimized.

The Northeast Council Recycling Council (NERC), with support from The Environmental Protection Agency, has produced a manual geared for municipal solid waste programs. The manual, reinforced by a survey of 176 collection events and curbside programs, provides suggestions, budgets and strategies to assist program managers in making their events more efficient.

Some collection programs either partner with reuse organizations, or are assured by fee-based recyclers that some of the electronic products sent to them are reused. Unfortunately, the event itself rarely realized any earned income from the sale of reusables, as the fees paid to process CRT's and other recyclables "zero's –out" revenues. In addition, a good number of collection programs don't know the end fate of the materials they collect and send to the recyclers.

Curbside collection proves to be the most cost-efficient, at $304 per ton. Average program cost, for all types of collections, is $3,086. As the two recent start-up programs in Missouri indicate, programs that are new incur start-up expenses that far exceed this national average. Based on the skills and knowledge of both Missouri Program Managers, it is expected that if further collection programs were conducted, expenses would be reduced to match national averages.

The total cost to process 8,046 tons of materials, which is the same amount used to evaluate the Electronics' Demanufacturing/Recycling and the Community Electronic Reuse Center models, in the upcoming Section VIII, is $1,241,498. It would take 402 collection events, priced at NERC's average of $3,086 collecting 20 tons per event to acquire the 8,046 tons.

VIII. Facility Based Models

Obsolete and end-of-life electronics management is also accomplished quite successfully by permanent facilities, operating daily in the form of for-profit businesses or nonprofit organizations. Various models operate in Missouri, as well as other communities across the country, and facilities range from those focused strictly on demanufacturing and recycling, to those offering reuse and recycling services, and those that do both.

The same strategic-business planning process describe in this section, (VII – A), can be utilized to test the feasibility and profitability of operating an enterprise in a specific community, or on a statewide basis. Two facility-based models and their accompanying budget projections are provided. The first model describes a single demanufacturing/recycling facility, and the second describes a model combining reuse and some recycling of electronics with community development.

A. Methodology and Assumptions

To level the playing field, it is estimated that both models will collect approximately 8,046 tons of electronic materials. This estimate was derived from Graph H2, (page 75) which reports the projected tonnage of obsolete computer electronics in Missouri generated in the years 2001 through 2007.

The 8,046 tons of materials represents 15% of the estimated 52,440 tons projected for the year 2002, equaling 7,866 tons. An additional 180 tons is added to this subtotal to reflect the amounts of electronics collected that are not computers, CRT-monitors and televisions, or peripherals.

The Electronics Demanufacturing/Recycling Model assumes that of the total 8,046 tons collected, 95% will be recycled and 5% will be sold as complete units or parts and components.

The Community Electronics Reuse Model assumes that of the total 8,046 tons of electronics collected, 15% be sold as complete units or parts and components. The exceptions to this are computers and televisions. For this model, it is estimated that only 5% (not 15%) of the total computers and total televisions collected will be refurbished for reuse. The remaining (approximate) 85% of total electronics collected will be recycled. It is also assumed that this model will not generate revenue from the 85% of materials recycled as the fees charged to process CRT-monitors and televisions will “zero-out” potential recycling revenues. Although this assumption was made, it is easily challenged - especially if CRT-monitors and televisions are banned from Missouri landfills. Banning would most likely result in additional income derived from the fees charged to consumers for the collection of monitors.

Many assumptions and averages had to made to account for the inestimable differences for each product categories' age, size, manufacturer and popularity. Prices in general are averaged based on "price shopping" numerous retailers and dealers during First Quarter 2002. Only complete computer systems sales are reported, although it is acknowledged that sales of just CPU's will occur.

To maintain a "level playing field", neither model's Profit/Loss statement reports unearned income from grants or other sources.

- Chart V reports in detail how revenues for the Electronics Demanufacturing/Recycling Model were determined.

- Chart VI reports in detail how revenues for the Community Electronics Reuse Centers Model were determined.

Chart V: Reused Equipment and Recycled Material Revenues

Reused Equipment				
CPU, Monitor, Keyboard and Mouse			*Miscellaneous Electronics*	
Pentium 133	$100		Working TV	$45
Pentium 166	$125		VCR's	$20
Pentium 233	$200		Desk top copiers	$65
Above Pentium-233	$425		Electric typewriters	$20
Average older Mac system (<9100)	$75		Overhead or slide projector	$50
Average newer Mac system (>9100)	$175		CD burners	$55
Laptop PC (average of all)	$200		Speakers	$5
Laptop Mac PowerBooks	$150		Individual phones	$5
Adjusted Average:	$*150*		*Adjusted Average:*	$*25*
Monitors			*Major Parts and Components*	
14"	$45		Hard drives, below 1 Gig	$10
15"	$55		Hard drives, above 1 Gig	$25
17"	$75		Keyboards	$5
19" or larger average price	$175		Mouse	$2
Adjusted Average:	$55		Modems	$10
			Power cords	$1
Printers			Printer cables	$3
HP LaserJet's (average of all)	$125		Miscellaneous cards, video, network	$10
Non HP LaserJet's (average of all)	$85		Low end processors	$10
Inkjet (average of all)	$35		Higher end processors	$20
Adjusted Average:	$*35*		RAM	$5

Scanners			**Recycled Materials**	
Older	$15		CRT monitors and televisions	-$6.00
Newer	$25		Electronic scrap	$0.04
Adjusted Average:	*$20*		CPU's	$0.06
			Printers	$0.00
Fax			Keyboards/Mice	$0.00
Thermal	$35		Copiers	$0.00
Plain paper	$75		Hard drives	$0.14
All-In-One	$125		Telephones	$0.06
Adjusted Average:	*$35*		Power Supplies	$0.02
			Insulated Wire	$0.10
			Mixed boards	$0.60
			Low grade boards	$0.20
			Medium grade boards	$0.60
			High grade boards	$1.25
			Super grade boards	$2.50

B. Electronics Demanufacturing/Recycling Model:

- Electronics The Demanufacturing/Recycling model is designed around a 40,000 square foot, single story facility with adequate docks, drive-in garage, parking, handicap accessibility, and 2,500 square feet of office space.

- The facility will be a collection and processing plant for obsolete electronics, including computers and their peripherals, CRT-monitors and televisions, other business electronics and some household electronics.

- The proceeding budget includes equipment for shredding and pulverizing, system engineering and set-up. These costs, as well as some of the equipment and storage and renovation costs, should not be factored in on a yearly profit and loss statement, but rather treated as start-up costs.

- Although the facility could potentially market its collection services to other states, for the purpose of this study, only Missouri is considered.

- The facility will employ 18 full-time staff.

- In addition to a paid staff comparable to other similar facilities, this model includes a Volunteer Coordinator, responsible for recruiting, training, and maintaining a volunteer base of 25-35 individuals, equivalent to three full time positions. Volunteers will be assigned to material handling, assisting in preparing electronics for recycling and reuse, and receptionist responsibilities.

- The facility will not process CRT's, but rather will charge for their collection and then ship them to a CRT recycling facility.

- Chart VI provides start-up costs and first year profit/loss for the Electronics Demanufacturing/Recycling Center.

Chart VI: Start-up Costs and First Year Profit and Loss

INCOME			
Revenues from recycling	$649,867		
Revenues from reuse	$872,642		
Subtotal Gross Revenue:		$1,871,174	
CRT INCOME/EXPENSE			
Collection Fees **(1)**	$530,900		
Fees to Recycle **(1)**	-$272,500		
Shipping **(2)**	-$44,505		
Net CRT Income		$213,895	
Net Income			$1,736,404
EXPENSES			
• Staff Salaries			
Executive Director	$65,000		
Director of Marketing/Sales	$45,000		
Operations Manager	$52,000		
Director of Reuse Sales	$38,500		
General Sales Assistant	$22,000		
Comptroller	$45,000		
Receptionist/Bookkeeping	$28,000		
Volunteer Coordinator	$28,000		
Computer Tech 1	$35,000		
Computer Tech 2	$35,000		
Driver	$27,500		
Driver Assistant	$18,000		
Warehouse Manager	$32,000		
Material Handler 1	$18,000		
Material Handler 2	$18,000		
Material Handler 3	$18,000		
Equipment Operator 1	$25,000		
Equipment Operator 2	$25,000		
Subtotal Staff Salaries		$575,000	
Benefits @ 28%		$161,000	
Total Staff Salaries & Benefits			$736,000
• Equipment and Storage			

Shredder	$245,000		
Pulverizer & Conveyors	$225,000		
Loading Dock Conveyor	$19,000		
Dust Collection	$67,000		
Installation of equipment	$140,000		
System Engineering	$20,000		
Truck	$32,000		
2 - Forklifts	$14,500		
12 Hand dollies	$975		
6 - Pallet Jacks	$4,500		
Testing & Diagnostic Equipment	$7,500		
24 Sets of Hand Tools	$4,400		
3 Compressors	$1,500		
6 Air Wrenches	$2,400		
4 Air Cutters	$1,200		
Pallet Racking	$3,750		
Pallets	$750		
Cardboard Containers	$3,200		
Banding Equipment	$2,200		
Parts Shelving	$1,500		
300 - Parts Bins	$900		
Safety Equipment	$2,500		
Cleaning Equipment Supplies	$450		
Subtotal Equipment		$800,225	
• Office Equipment			
12 - Computer Systems **(3)**	$0		
Software	$4,800		
Networking Hardware, etc.	$2,200		
12 – Printers **(3)**	$0		
2 – Digitizers **(3)**	$0		
2 Photocopiers **(3)**	$0		
1 High production copier	$2,600		
Cash Registers	$250		
Fax Machine **(3)**	$0		
Equipment Maintenance Supplies	$1,200		
Phone System	$4,200		
Alarm System	$2,875		
Office Supplies	$3,600		
Furniture	$3,500		
Subtotal Office Equipment		$25,225	
• Operational Costs			
Rent **(4)**	$80,000		
Initial Renovations **(5)**	$90,000		
Building Repairs/Maintenance	$6,500		
Demanufacturing Equipment Repairs/Replace	$40,000		

Other Equipment Repair/Replace	$4,500		
Truck Fuel	$6,800		
Truck Insurance	$2,600		
Advertising	$18,000		
Printing	$3,200		
Building Insurance	$2,890		
Other Insurance	$11,500		
Utilities **(6)**	$13,200		
Telephone	$4,450		
Alarm service	$1,250		
Postage and Freight	$2,800		
Accounting Fees	$5,500		
Permits	$2,000		
Legal Fees	$3,000		
Bad Debt Expense	$17,364		
Cash Shortage	$1,000		
Staff Development	$6,500		
Publications	$350		
Memberships	$2,800		
Conferences	$5,200		
Travel	$2,800		
Subtotal Operational Costs:		$334,204	
Total All Expenses			$1,895,654
Net Income			*$1,736,404*
Total Expenses			$1,895,654
Net Profit/Loss			-$159,250

Additional budget notes:

(1) Collection Fees: based on collecting 58,898 CRT's and TV's @ $9 per monitor.
(1) Fees to Recycle: based on paying $5 per monitor.
(2) Shipping: based on 58,898 CRT's, 825 per truck equals 69 trucks @ $645 per truck.
(3) It is assumed that computers, printers, and other business electronics will have no cost, as they will be acquired by collections.
(4) Rent: based on having to lease @ $2 per sf. annually.
(5) Renovations: based on remodeling 2,500 sf. of office @ $22 per sf. ($55K), Tech lab ($15K), and other @ $20K.
(6) Utilities: based on 30¢ per sf., plus add on of 10% for fluctuations.

C. Community Electronics Reuse Center Model:

- The Community Electronics Reuse Center Model (CERC) combines the reuse, repair and redistribution of obsolete and end-of-life electronics with community development.

- This model will promote using four centers or businesses throughout Missouri to collect and process the targeted electronics. The

electronics, including computers and their peripherals, CRT-monitors and televisions, other business electronics and some household electronics, will be acquired from area businesses and households. This model and can link with collection programs not conveniently located to the CERC's. It is also assumed that this model will lessen the need in areas surrounding the CERC's for the more costly specialized electronics collection events.

- The CERC's will ready or repair electronic equipment that is reusable. Recyclable electronics will either be triaged and sent to area or regional electronics' recyclers prior to their arrival at the CERC's, or minimally triaged on site. The reusable electronics will be sold to the community at large. Revenues generated from sales will support the daily operations of the center. It is assumed that no revenue will be generated from recycling, as the fees to recyclers for CRT's will "zero-out" any income potential.

- The daily operations of the CERC's will also provide additional benefits to community groups and individuals. For example, partnerships with nonprofit groups such as the YMCA, The Helping Hand of Goodwill, Jewish Vocational Services, Junior Achievement, Rehabilitation Institute, and schools and congregations, will be developed with the goal of utilizing the business of electronics reuse to provide educational, entrepreneurial and vocational programs. More specifically, opportunities will be offered such as: teaching young adults how to operate a business; teaching youth and adults how to use computers for school and work, or to design web-sites; teaching material handling and other skills; utilizing the CERC's for job readiness skills; or training youth how to teach older citizens how to use computers.

- CERC staff including, a Volunteer and Community Program Coordinator, a Job Coach, and at least one Technician with teaching skills will support the community-building component.
- Some of these activities and partnerships are currently in existence in nonprofit and for-profit businesses and organizations in Missouri. To some degree, this model is no more than a reinforcement of those efforts. Although occurring – they could be taking place on a larger scale with expanded results. Goodwill Industries, Gunther Electronics, and Laclede Computer Trading Company in St. Louis; Surplus Exchange, Pan-Educational Institute and Corporate Asset Services in Kansas City; and Fredrick Enterprises in Columbia, if willing, could take part in this model by expanding their businesses. This would greatly reduce the start-up and ongoing costs. If these or other comparable existing businesses or organizations cannot

participate, the budget provides estimations for the initial facility costs and first year profit/loss.

- Chart VII reports, in detail, start-up costs and first year profit/loss for the each individual Community Electronics Reuse Center.

Chart VII: Start-up Costs and Profit/Loss for One CERC

INCOME			
Revenues from reuse **(1)**	$567,878		
Net Income			$567,878
EXPENSES			
• Staff Salaries Per Facility			
Executive Director	$45,000		
Director of Reuse Sales	$32,000		
Receptionist/Bookkeeping	$28,000		
Volunteer Coordinator/Community Coordinator	$32,000		
Warehouse Manager	$35,000		
Job Coach	$32,000		
Computer Tech 1	$37,000		
Computer Tech 2	$35,000		
Driver	$27,500		
Driver Assistant	$18,000		
Material Handler1	$18,000		
Subtotal Staff Salaries		$339,500	
Benefits @ 28%		$95,060	
Total Staff Salaries & Benefits			$434,560
• Equipment Per Facility			
Truck	$32,000		
1 - Forklift	$7,250		
8 Hand dollies	$650		
2 - Pallet Jacks	$1,500		
Testing & Diagnostic Equipment	$2,500		
6 Sets of Hand Tools	$1,100		
1 Compressor	$500		
1 Air Wrench	$400		
Pallet Racking	$600		
Pallets	$250		
Cardboard Containers	$600		
Parts Shelving	$250		
100 - Parts Bins	$300		
Safety Equipment	$900		
Cleaning Equipment Supplies	$250		
Subtotal Equipment		$49,050	

• Office Equipment			
4 - Computer Systems **(2)**	$0		
Software	$1,600		
Networking Hardware, etc.	$400		
4 – Printers **(2)**	$0		
1 – Digitizers **(2)**	$0		
2 Copy Machines **(2)**	$0		
Cash Register	$250		
Fax Machine **(2)**	$0		
Equipment Maintenance Supplies	$400		
Phone System	$1,200		
Alarm System	$1,400		
Office Supplies	$900		
Furniture	$700		
Subtotal Office Equipment		$6,850	
• Operational Costs			
Rent **(3)**	$45,000		
Initial Renovations **(4)**	$15,000		
Building Repairs/Maintenance.	$3,500		
Other Equipment Repair/Replace	$1,000		
Truck Fuel	$6,800		
Truck Insurance	$2,600		
Advertising	$2,500		
Printing	$800		
Building Insurance	$1,500		
Utilities **(5)**	$4,950		
Telephone	$960		
Alarm service	$840		
Postage and Freight	$500		
Accounting Fees	$2,400		
Permits	$750		
Legal Fees	$2,500		
Bad Debt Expense	$1,467		
Cash Shortage	$1,000		
Staff Development	$2,400		
Publications	$350		
Memberships	$1,800		
Conferences	$1,300		
Travel	$700		
Subtotal Operational Costs:		$100,617	
Total All Expenses			$591,077
Net Income			*$567,878*
Total Expenses			$591,077
Net Profit/Loss			*-23,199*

Net Income For All Four CERC's			$2,271,512
Total Expenses For All Four CERC's			$2,364,308
Net Profit/Loss For All Four CERC's			-$92,796

Additional Budget Notes:

(1) Revenues reported is for one CERC, which represents 1/4 of the total $2,346,608 collected by all four CERC's.

(2) It is assumed that computers, printers, and other business electronics will have no cost, as they will be acquired by collections.

(3) Rent: based on a minimum of 15,000 sf. @ $3 per sf. annually.

(4) **Renovations: based on 1,000 sf. offices, 1,000 sf. classrooms, and other general remodeling**

(5) Utilities: based on 30¢ per sf., plus add on of 10% for fluctuations

D. Summary:

It is estimated that the Electronics Demanufacturing/Recycling model will realize $1,736,404 in revenues, and $1,895,654 in expenses and set up cost its first year of operation. Net loss will be -$159,250. First year projections merge set-up costs and first time major equipment purchases with operating income and expenses, and do not report any unearned income in the form of grants.

It is estimated that the Community Electronics Reuse Center model, (all four centers combined) will realize $2,271,512 revenues, and $2,364,308 in expenses and start up costs its first year of operation. Net loss will be $23,199 per Center, or -$92,796 for all four CERC's. First year projections merge set-up costs with operating income and expenses, and do not report any unearned income in the form of grants.

The two facility-based models give emphasis to one of the differences between reuse and recycling – that reuse holds a greater potential for an obsolete electronics management strategy to provide additional benefits to the community, other than just environmental.

Although the immediate waste diversion impact for reuse is greater, (and thus its' higher ranking in the waste management hierarchy), theoretically, and if reuse and recycling are both part of the targeted electronics' life cycle, all materials will eventually reach the recycling phase. Thus, the long-term economic impact, as it applies to just waste diversion, is at least the same for reuse and recycling. The "added-value" feature for reuse is the proven potential it holds for social, educational and vocational enhancements within a community, and as a result, building upon the assets of individuals which stimulate economic development. If one chooses to evaluate reuse vs. recycling strictly based on dollars, it is only reasonable and fair to factor in the economic impact reuse has on the learning and earning potential of individuals.

The projected profit/loss provided for both models merge start-up costs with operational income and expenses. This affects the first year bottom line for both models. For example, the Demanufacturing/Recycling model will not be purchasing and installing almost $600,000 of equipment each year. Nor will the CERC model be spending $25,000 per center each year for building renovations. The purpose of the budget for each model is to establish an economic baseline from which to evaluate the income and expenses for each type of operation. In addition, if existing centers or businesses are utilized for either model the expenses should be greatly reduced. And, if existing businesses were utilized for the CERC model, most likely the 8,046 tons used for the evaluation would be exceeded.

It is also important to review each model, or any strategy for that matter, with a consideration for all factors affecting the flow of materials and daily operations. Although either model may seem a reasonable approach “on paper”, success will be also determined by management and staff, supply and demand for products, current prices paid for commodities, and other factors such as state and national legislation and regulation of electronic products, and national programs directing end-markets.

IX. Summary

This section will report: 1) a summary of all major data and information; 2) recommendations that will help guide the state of Missouri to make informed decisions regarding the most efficient and fiscally responsible means of supporting the management and market development of obsolete electronics.

A. Data Collection and Survey Results:

1. The state of Missouri is faced with two problems regarding the vast amounts of obsolete and end-of-life electronics potentially entering its' landfills. First, what are the best solutions to effectively deal with the obsolete electronics currently requiring management? Secondly, what should be done now, to reduce the future flow of these targeted materials headed for the waste stream?

2. Nationally, the estimated number of computers becoming obsolete in the year 2002 is almost 41 million. Of those, it is predicted that only 5 million will be reused or recycled.

3. Based on adjustments made to national statistics reflecting Missouri's demographics and survey results, an estimated 15 million computers, peripherals, CRT-monitors and televisions will become obsolete in Missouri between 2001-2007. This equals just over 436,000 tons.

4. Of the approximately 15 million units becoming obsolete, only 2 million units (or 50,000 tons) will be reused or recycled. This leaves 13 million units (386,000) unaccounted for.

5. Of the households responding to this project's survey, 56% report replacing an existing computer with a new one every 3-4 years. Fifty percent of the businesses responding also replace an existing computer with a new one every 3-4 years. Seventy-eight percent of the businesses responding report that they are utilizing computers longer (than in previous years) before replacing them.

6. Sixteen percent of the households responding have at least one unused computer system at home in storage, and conversely, 84% report having none. Sixty-three percent of businesses responding report having computer systems in storage.

7. The most common reason households report for not getting rid of unused computer equipment is value. Forty-seven percent believe the equipment they have in storage has retained 50% of its original value.

8. Thirty-three percent of the households surveyed have at least one television at home not in use. Reasons given for holding on to

unused televisions include respondents saying they will use it at a future date (34%), and believing the TV is too valuable to get rid of (21%). Throwing a television away is the most common method of "management" used by households.

9. If the estimated total of obsolete electronics generated in Missouri between 2001-2007 is managed based on what Missouri households and businesses report as the ***methods they have used in the past***, the results would be:
    - 4 million computer electronics and televisions will be donated.
    - 3.8 million computer electronics and televisions will be thrown away.
    - 3 million computer electronics and televisions will be sent to reuse or recycling enterprises.
    - 4.7 million computer electronics and televisions will be stored, traded, or given away to other than charities.

10. Eighty-four percent of the computer electronics collected by reuse and recycling dealers come from businesses, while conversely, 16% come from households.

11. Sixty-eight percent of the dealers selling new equipment report a decrease in new computer sales. They also report a steady growth in the sale of peripherals and monitors.

12. Sixty-seven percent of the households and 40% of the businesses surveyed said they <u>were not</u> aware that computer electronics contain toxic materials that have the potential to pollute the environment. Only 21% of the households surveyed acknowledged knowing that televisions contain toxic materials.

13. When households were asked what amount they considered a reasonable fee to pay for the proper handling and management of a single obsolete electronic, 15% thought there should be no fee, 37% said less than $5, and 24% indicated between $5 and $10 as a reasonable amount to pay.

14. With the exception of business consumers, all groups interviewed hold others more responsible then themselves for the costs required to properly manage obsolete electronics.

B. Factors Affecting Market Development in Missouri:

1. National and world markets, pricing structures and distribution systems will influence market development, particularly end-markets for the obsolete electronics generated in the state of Missouri. In addition, decisions made on the national level regarding electronics management and legislation and regulation will influence every state's management strategies, including Missouri's. Some of the major plans and topics currently under considerations, which will impact Missouri, are the Environmental Protection Agency's Universal Waste Rule for CRT's, and the National Electronics Product Stewardship Initiative (NEPSI) dialogue.

2. Missouri's electronics infrastructure is in the formative stages of development. Current collection and processing alternatives are insufficient and often times not known to all stakeholders and decision makers. Currently, legislation and regulation of electronics, particularly CRT's, is unclear to many individuals and businesses. The uncertainty of how CRT's and other electronics can be disposed of, *(are they waste or are they a commodity?),* influences availability of product and costs for their collection and processing.

3. The volume alone of obsolete electronics is not the problem. Electronic products contain a multitude of hazardous materials, commonly referred to as E-waste. It is estimated that although electronics make up only 1%-3% of landfill content, they are responsible for 50%-75% of the heavy metals found in landfills. The lead found in CRT monitors, as well as mercury, cadmium, brominated flame-retardants, and other hazardous materials found in computer parts and components – all affect the economics of computer electronics' reuse and recycling.

4. The revenues generated from the reuse and recycling of electronics continues to drop, while expenses edge higher. In comparing prices paid by recyclers for electronics in the years 2000 vs. 2002, prices dropped 19%-57% (depending on the item) for electronics in 2002. In 2000, a truck with a 33,300-pound load of recyclable electronics would have generated $3,781 in recycling revenue, while this same load in the first months of 2002 would only bring $2,169 – a decline of 43%. Numerous factors affect revenues generated, including: hazardous content, the continual introduction of new innovative products at cheaper prices, hardware incompatibility, software licensing issues, labor and transportation, and other costs to run a facility's or program's daily operations.

C. National Electronics Efforts

1. National efforts by equipment manufactures, retailers, recyclers, the federal government and other established working groups, can significantly determine what will and will not work in Missouri. The following are national efforts and organizations potentially influencing market development in Missouri:
    i. Product stewardship initiatives have become a large part of the overall discussion of obsolete electronics management, as well as solid waste in general. Product stewardship can take several forms. It might mean businesses and governments making revisions in their procurement standards in order to specify certain end-of-life options. It could also involve seeking and specifying computer equipment that is more easily upgradeable, reusable, and recyclable as a means of making certain that the equipment can be more easily managed at the end of its useful life. Currently, the Product Stewardship Institute is taking the lead on these types of issues.

    ii. The National Electronics Product Stewardship Initiative (NEPSI). Initiated in April 2000, it consists of a stakeholder-working group of 45 participants representing county, state and federal governments, original equipment manufactures, environmental groups, recyclers, non-profit organizations, and retailers. The goal of NEPSI is to develop a model to address issues of collection, reuse, recycling, financing, regulation, market development, procurement and design for obsolete and end-of-life household computer electronics and consumer televisions. At the time of this writing, the stakeholders have agreed upon two important assumptions: 1) that it is likely there will need to be some sort of upfront collection fee to cover the costs of electronics management; and 2) that legislative action may be required in order to implement this fee on a national basis.

    iii. Electronics Products Recovery and Recycling (EPR2) Project. This is a project of the National Safety Council's Environmental Health Center. It is ongoing and promotes environmentally safe, responsible, and cost-effective management of end-of-life electronics. It funded the EPR2 Baseline Report: "Recycling of Selected Electronic Products in the United States".

    iv. Environmental Protection Agency Regulatory Status. One of the most difficult issues for states and communities has been

the lack of comprehensive legislation and regulation surrounding electronics management. This creates problems for service providers working to collect, process or dispose of electronics. As a result, EPA will be publishing a new Universal Waste Rule for CRT's. The rule was developed to encourage and support businesses wanting to recycle CRT's.

v. Export initiatives such as the Basal Action Network (BAN)/Silicon Valley Toxics Coalition Report on Export. Published in February 2002, the BAN report revealed that huge quantities of electronic wastes collected in the United States are not processed domestically, but rather exported to China, Pakistan, India, and other countries where their processing techniques become harmful to human life and the environment. The report makes it clear the United States has simply shifted a substantial part of the E-waste burden to these countries. Although there are electronic exporters and importers concerned with the proper management of these materials, many are not, causing great harm to the recipient importing countries.

vi. Both Unicor, the federal government program, and a variety of state programs are currently engaged in or considering getting in the business of electronics recycling as part of their prison labor programs. Although there are economic and job training benefits, using prison labor also raises issues such as exposing inmates to hazardous materials found in electronics, below market wages, and for-profit recyclers then having to compete with government programs.

vii. Organizations representing the electronics industry are involved in bringing together different interests to address the critical technical, economic, ethical and social interests concerning the industry as a whole. These include the Electronics Industries Alliance (EIA), the International Association of Electronics Recyclers (IAER), and the International Symposium on Electronics and the Environmental Electronics Recycling SUMMIT.

viii. Although not mentioned in the main body of the report, national organizations such as the Reuse Development Organization (ReDO), and the National Recycling Coalition are both involved in promoting electronics reuse and

recycling strategies that are environmentally sound, economically feasible and beneficial to the community.

ix. National Private Sector, Retailer, and Manufacturer's efforts to encourage the reuse and recycling of targeted electronics. These include Waste Management Recycle America, the Best Buy program, and programs offered by manufactures such as Hewlett Packard, IBM, Sony, and Dell. These initiatives utilize a combination of product "take back" and partnerships between municipalities, nonprofit organizations, retailers, and manufactures to collect and process obsolete and end-of-life electronics.

D. Collection Programs

1. Collection models are a common strategy for managing obsolete electronics. The cost in dollars and personnel to run collection programs usually falls on the shoulders of government funded solid waste programs. Collection models are usually one of three types: ongoing drop-offs, a single or series of special drop-off events, or curbside pickup. The Northeast Recycling Council (NERC) has collected the most significant data on collection models, identifying approximately 500 programs, and compiling survey results from 176 responding programs.

   Recently, two collection programs took place in Missouri. Saint Louis County Department of Health's Waste Management Branch Consumer Electronics Product Stewardship Program (DOH) and The Mid-America Regional Council's Solid Waste Management District (MARC) each held electronics collection events. A detailed summary for each program is found in Section VII, Collection Programs. *For this summary, DOH's and MARC's results are compared to NERC's results and italicized.*

2. NERC's survey reports that all but one collection program target residences as the primary participant. Only 24% of the programs restrict participation to residences, with the balance allowing some businesses and institutions to also participate. *Both DOH and MARC targeted residences only.*

3. Nationally, the average number of households participating per year varies with the collection model. Ongoing drop-offs have the highest participation rate, averaging 1,019 households per year; curbside averages 732 households per year; and special events average 463 households per year.

4. All programs accept computer monitors, and these are the most common electronic collected by programs. *DOH and MARC both accepted CRT monitors and televisions. DOH also accepted*

phones, stereos and other household electronics. MARC discouraged other household electronics.

5. Nationally, an average of 55,815 pounds of electronics was collected per event. The high amount was 140,000 pounds and the low was 11,168 pounds. Events averaged 474 vehicles, and the average weight dropped off was 118 pounds per vehicle. This information is based on data from only 19 of the programs surveyed. *DOH had 330 participants averaging 73 pounds per participant. MARC had 491 participants for three events, averaging 78 pounds per participant.*

6. The NERC study reports an even split between programs charging participants a fee and those that do not. When a fee is charged, it is most commonly for CRT monitors and TV's. The average fee for CRT's is $5, with fees ranging from $3 to $20. With the exception of a program in Indiana, which receives revenues of $20 per ton, all programs pay a recycler a fee. In addition, 12% of the programs report that the fee they pay is for CRT's only, and that the recycler at no cost takes the balance of electronics. *DOH did not charge participants a fee. MARC charged $12 per monitor, 25¢ per pound for non-console TV's, most computer peripherals were free, and other electronics at 25¢ per pound*.

7. Nationally, the average cost to set up a program event was $3,086, with 80% of respondents reporting set up costs to be under $5,000. Set up costs depends on the model, the population served and tenure of the program. Cost per ton to collect electronics is: $304 for curbside programs, $464 for special events, and $448 for ongoing drop-offs. *DOH's program cost $17,853, making the cost per ton collected $1,480. MARC's three events cost a total (revenue less expenses) of $11,055, or $580 per ton. Both were start-up programs, incurring costs that would be minimized if collection events were continued.*

8. Unfortunately, many of the programs surveyed by NERC do not substantially combine reuse with their collection events. In addition, many programs do not know the fate of the materials they turn over to recyclers. *DOH sent all the collected materials to United Recycling for processing. MARC partnered with the Surplus Exchange for the events, making use of the organization's electronics reuse and recycling services.*

9. If collection events were utilized to process the same 8,046 tons of materials used to evaluate the two facility based models, it would take 402 collection events, averaging 20 tons per event. Then using NERC's average cost of $3,086 per collection event, the total cost to collect the 8,046 tons would be $1,241,498, or $154 per ton.

E. Facility Based Models

1. Obsolete and end-of-life electronics management is also accomplished by permanent facilities operating on a daily basis as for-profit businesses or nonprofit organizations. Various successful models exist in Missouri offering a range of demanufacturing, recycling, and reuse services
2. Two models are described for this report, an Electronics Demanufacturing/Recycling facility, and a Community Electronics Reuse Center model. Section VIII provides the methodology used to determine revenues and expenses for each model, as well as the amount of materials collected and processed.
3. The Electronics Demanufacturing/Recycling model is based on a single-story 40,000 square foot facility processing 8,046 tons of materials per year. It will employ 18 full time staff and utilize a pool of 25-35 volunteers.
4. It is not recommended that the Electronics Demanufacturing/Recycling model fully process CRT's, but rather charge for their collection and ship them to a CRT demanufacturing facility.
5. It is estimated that the Electronics Demanufacturing/Recycling model will realize $1,736,404 in revenues, and $1,895,654 in expenses and set up cost its first year of operation. Net loss will be -$159,250. First year projections merge set-up costs and first time major equipment purchases with operating income and expenses, and does not report any unearned income in the form of grants.
6. The Community Electronics Reuse Center (CERC) will combine the reuse, repair and redistribution of obsolete electronics with community development in the form of educational, economic, social, and vocational programs and opportunities.
7. This model will promote using four centers or businesses (preferably existing) throughout Missouri to collect and process 8,046 tons of electronics per year.
8. The minimal size for each CERC facility is 15,000 square feet. Each center will employ 11 full time staff, including a Volunteer and Community Coordinator and a Job Coach.
9. It is estimated that the Community Electronics Reuse Center model, (all four centers combined) will realize $2,271,512 revenues, and $2,364,308 in expenses and start up costs its first year of operation. Net loss will be -$23,199 per Center, or -$92,796 for all four CERC's. First year projections merge set-up costs with operating income and expenses, and does not report any unearned income in the form of grants.

X. Recommendations

Unfortunately, there are no easy answers for the best ways to expand existing, and develop new, markets for obsolete and end-of-life electronics. Some stakeholders and observers involved in the "industry of obsolete electronics" criticize the solution process, saying that the critical impediments for successful market development have been voiced for years but avoided. These same stakeholders identify product design issues, and legislation and regulation as the major changes required to affect desired results. The bad news, there is still an unwillingness on industry's part to address product design issues at the magnitude they deserve. The good news, the slowness in movement towards legislation and regulation is speeding up. National attention and policy considerations such as the NEPSI dialogue and EPA's Universal Waste Rule for CRT's have the potential to help the industry focus on the major obstacles to improving the situation. Maybe the costs potentially imposed on manufacturers by legislation and regulation, will help them reconsidered product design issues.

The question was raised early on in this document is obsolescence the problem, or is it obsolete products, which contain toxic and hazardous materials, and encumbered by product design, which offer the greatest challenges? It might not be the number of electronics becoming obsolete that is the problem, but rather the number becoming obsolete that are so expensive to collect and process due to their hazardous content and product design. The reader was asked to envision a scenario, that may not be possible, but by all rights has not been tested, which is - what would this industry look like:

- If toxicity and product design were mostly eliminated from the profit/loss equation?
- If OEM's were not discouraged from manufacturing new products, but only from manufacturing products dangerous and expensive to reuse and recycle?
- If entrepreneurial solutions which provided economic, social, educational and vocational benefits to the community were included in the management scheme?

If the original equipment manufactures (OEM's) and retailers continued to manufacture and sell products, *causing* the same amount of electronics becoming obsolete as current predictions indicate, *but* the factors most responsible for reuse and recycling expenses outweighing revenues were minimized, *and* the entire process supported community asset building – *wouldn't obsolete electronics then become a positive commodity, and then encouraged?*

Many factors and stakeholder interests drive and influence the process of identifying and developing the best solutions for obsolete and end-of-life

electronics management. Dialogues and forms, such as NEPSI, the Product Stewardship Institute, and EPR2, represent many stakeholder groups. These include government, original equipment manufactures (OEM's), environmental concerns, product design specialists, nonprofit organizations, reusers and recyclers, and new product retailers. One stakeholder group often not represented is the consumer. Although many of the other stakeholders believe they can identify what the consumer wants, or voice what is in the best interests of their constituents, representation revealing what the consumer wants around this topic is most often missing from these discussions.

For example, OEM's and retailers often report that they are "innocent by-standers" –that they only manufacture and sell what the consumer wants. They assert the process is market driven based on consumer desire. Critics would say this is not the case. That in fact, OEM's and retailers are clever, and their profit-motive-strategies are well timed to create and drive the consumers' interest in electronic products that are faster, smarter, and cheaper. Most likely both sides have valid points. But, to demonstrate the importance of consumer representation, let's assume that in fact OEM's and retailers are right, and they are only giving people what they want.

One would think then, that it would be pertinent to include the consumer in the decision making process and find out if consumers are aware of the issues, such as the toxic content of the electronics they purchase. It would be important to find out if consumers are willing to pay more (and determine how much more) for a safer product; and what fee are consumers willing to pay to contribute to the over-all management of obsolete and end-of-life electronics. The question then needs to be asked: If OEM's and retailers are consumer driven, are they willing to respond to a consumer, who once educated to the issues and economics of the products, requests and is willing to pay for a product that is not just better and faster, but *better and faster and safer?*

Based on the premise that the best way to support and encourage obsolete and end-of-life computer related electronics market development is to first change product design and encourage legislation and regulation, the following recommendations are made:

Recommendation #1: For the state of Missouri to continue participation in initiatives supporting product design changes.
Often times, with a concern so vast and influenced by so many factors, it is hard to know where to jump in and use ones resources to affect the greatest amount of change. It is this researcher's belief that product design, resulting in safer and easier to manage products, precedes all other efforts. Redesigning products to reduce their hazardous content and making them easier to dismantle and upgrade is a future investment impacting all other environmental, governmental, economical and social considerations. OEM's

and retailers should not be asked to limit their consumer activity, but demands should be placed on them to make a safer product, which has value as it moves through its life cycle. Market development is based on having a commodity, which generates activity resulting in (future) profits. Right now, the market is speaking loud and clear – the commodity is too dangerous and expensive to collect and process, and profits are too low.

Recommendation #2: Quickly consider and implement strong legislation and regulation of certain electronics.
Massachusetts is a good example of how legislation and regulation can have a positive effect on market development. It is hard for any business or organization to deal with a product that so quickly goes from being a commodity one day, (with different values at different times in its life cycle), to becoming trash the next. Massachusetts has shown how a state's infrastructure-development-plan, (which includes removing the hazardous waste label from intact CRT collection and processing, achieving a disposal ban on CRT's, and provides incentives for recyclers and reusers), give a boost to the industry. Missouri needs to quickly follow suit, and support an infrastructure that is safe for the environment and encourages market development. This ties in with *Recommendation #5,* as constituents who understand what is asked of them best support legislation and regulation.

Recommendation #3: Create a task force or stakeholder group to help define the state of Missouri's obsolete and end-of-life management strategies, mission statement, and objectives.
Using the NEPSI dialogue as a template, identify the major Missouri stakeholders, and develop a forum for them to meet and move towards the best solutions for Missouri. Missouri has a wealth of collective knowledge regarding the issues, programs and businesses currently managing the targeted electronics, and a SWMP that has shown initiative and ingenuity in its approach to funding and supporting management efforts. It will also be important to include representation from Kansas and Illinois. Both states border major Missouri metropolitan areas, and the boundaries preventing the flow of targeted electronics is virtually invisible. Continuing to coordinate efforts and stakeholder interests, and then formulizing a mission statement and set of goals, which includes but is more than the sum of the each stakeholders' interest, is crucial to the process. In addition, this approach will help manage the collective resources allocated to this process. This will provide standards and criteria for all stakeholders' interests and future solutions and strategies to be weighed against. And, having a common mission and set of objectives will provide focus for funders such as SWMP, assisting them in allocating their dollars and funding opportunities to a common strategy.

Recommendation #4: Create a gatekeeper and central database for the collection and dissemination of all information related to this topic.

This ties in with the previous recommendation, and will provide a time saving step for those involved in the industry. Missouri is no different than many other states in that there is so much activity going on, (both within and without the state), regarding the topic of obsolete and end-of-life electronics, that it is hard to keep up on the industry. The gatekeeper can function as the one-stop-shop for collecting and disseminating information, as well as identifying and coordinating end-markets for the targeted materials. The gatekeeper position can be housed separately or as part of an existing organization, including DNR, MORA (Missouri Recycling Association), or one of the Solid Waste Management Districts. Although this position will have associated costs, (estimated to be approximately $70,000, if not consolidated with another organization), it seems that expenses should be weighed against the benefits of having a single source that is responsible for coordinating electronics management efforts, and can efficiently identify and pass on to others the most current information and successful program strategies. Possibly, this will cut down on confusion and minimize the cost of reinventing the wheel.

Recommendation #5: Support consumer education and information regarding the topic.

Based on the surveys conducted for this project, 67% of households and 40% of businesses report not being aware of the hazards contained in computer electronics and televisions. Although these numbers are surprising high, they do reinforce the need for information, which will help consumers become better stewards of the products they purchase. Educational information should also be in the form of making the public aware of collection events and promoting permanent for-profit and nonprofit electronics management businesses and organizations. Overseeing this task can become part of the gatekeeper position described above.

Recommendation #6: Evaluate the economics of collection-model programs, and consider supporting an Electronics Demanufacturing Recycling model or a Community Electronics Reuse Center model.

Currently, the burden of managing the obsolete and end-of-life electronics that are the hardest to find markets for, falls on the shoulders of solid waste authorities. The method of management most often used by government-funded programs is the collection model, including on-going collections, special events, and curbside pickup. Although, effective in diverting materials from the waste stream, the cost per ton to do so is very high and managing collection events is not always the best use of solid waste authority or municipal personnel and resources.

As an alternative, additional consideration should be given to models that are facility based. In general, permanent facilities can yield less expensive cost-per-ton ratios and give stability and focus to a state's infrastructure development plans. Because the state of Missouri also includes large rural

areas, consideration might also be given to combining some targeted collection events that link with permanent facilities located in more populated parts of the state.

This project studied two facility models, an Electronics Demanufacturing Recycling model, and a Community Electronics Reuse Center model. Although both models have proven in the past to be successful, the model, which might make the most logistic and economic sense, is the Community Electronics Reuse Center (CERC) model. The reasons the researcher is biased towards this model include:

a) It appears that it is not a lack of demanufacturing and recycling facilities that is the problem; rather it is the lack of end-markets for end products that is the challenge. Based on the information acquired for this project, existing demanufacturing and recycling facilities are able to handle their current capacity as well as future increases of targeted materials. The state of Missouri is conveniently located to such facilities as its own Doe Run, and regional facilities such as United Recycling, in West Chicago, Illinois; Asset Recovery in St. Paul, Minnesota; or Blue Star Electronics, in Colorado Springs, Colorado, to name a few. Even considering the cost of transporting materials to another region or state's facility, creating another demanufacturing/recycling operation should be carefully evaluated with consideration given to existing competitors and the potential for future end markets.

b) Start-up costs, excluding salaries, for a single demanufacturing facility exceed the start-up costs for four reuse facilities. In addition, the CERC model holds the greatest potential for utilizing existing for-profit businesses and nonprofit organizations, thus reducing expenses, including initial set up costs. If existing enterprises are not utilized, the CERC model can be set up incrementally, one center at a time, requiring less initial investment and minimizing risks. Economic benefits to communities will be more wide spread with the CERC model. A single facility demanufacturing facility will localize economic growth to one community, while the CERC model will provide benefits to several Missouri communities.

c) Prices paid for reusable computer electronics do not fluctuate as much as they do for recyclable computer electronics. Rather than the continual drop in prices paid by recyclers, reusable electronics, with all else being equal, are steady. The consumer usually pays the same price but gets a faster-smarter product for the same amount of money. This adds a certain degree of stability to the reuse model.

d) Electronics reuse models tend to create a program synchronicity unable to be obtained by electronics demanufacturing and recycling models. Reuse models, linked to community development, are attractive to a variety of funders, businesses, and programs willing to either assist reuse initiatives, or educational, vocational and social related programs, or both. Organizations following this model, such as the Surplus Exchange in Kansas City, experience a variety of funding and support in the form of volunteers helping with the daily operations, as well as dollars to fund programs such as teaching urban-core kids how to build a computer, which they then get to keep.

In conclusion, there is no new "twist" or clever marketing strategy or advertising promotion, which can bridge the gap between: the overwhelming and continual supply of obsolete electronics; the environmental and economic difficulties their hazardous contents produce; and consequentially, the difficulties and expense to manage them. Successfully expanding existing, or developing new, end-markets for obsolete and end-of-life electronics in Missouri will result from bringing together the many inter-related issues covered in the recommendations above.

Additionally, this study reinforced the researchers previous belief that Missouri has numerous existing for-profit and nonprofit businesses and organizations already in the business of "obsolete electronics". It seems that any funding entity would first look to these as solution providers. For example, providing funds to support CRT collections to enterprises such as: Gunther Electronics, Goodwill Industries, or Laclede Computer Trading Company in St. Louis; and Pan-Educational Institute, Surplus Exchange, or Corporate Asset Recovery Services, in Kansas City; Frederick Enterprises in Columbia; and Habitat for Humanity in Springfield.

Certainly, the cost to collect these targeted materials can be reduced by bringing together state-efforts, such as coordinating collection events, or developing common resource-reduction objectives to fund and support. It seems, though, that the best efforts to reduce obsolete electronics from being a problem of this magnitude in the future will have to include minimizing their hazardous and toxic content. Affecting the problem at this level may seem to some, out of Missouri's reach, but it isn't, as evidenced by product stewardship initiatives and industry dialogues Missouri's decision makers are currently part of. If this is not addressed, the added costs and difficulties caused by inefficient and unsafe product design will continue to hamstring market development and place the burden of managing these materials on solid waste authority and municipal governments.

General US and MO Population Stuff

Statistics							
US Total Population	281,421,096						
MO Population	5,595,221						
MO Percent of Total	1.99%						
US Total Households	105,480,101	Population stuff from 2000 U.S. C ensus					
MO Households	2,194,594						
MO Percent of Total	2.08%						
US Total Nonfarm Establishments	7,008,444	Business stuff from U.S. Census 1999 data					
MO Nonfarm Establishments	144,874						
MO Percent of Total	2.07%						
calculating numbers based on my surveys:							
If I iinterviewed 155 businesses, this what? % of all MO. businesse	0.107%	So my surveys are a .107% representation of businesses					
If I iinterviewed 120 households, this what? % of all MO. HH's?	0.005%	So my surveys are a .005% representation of businesses					

My Estimate of how many MO households have computers

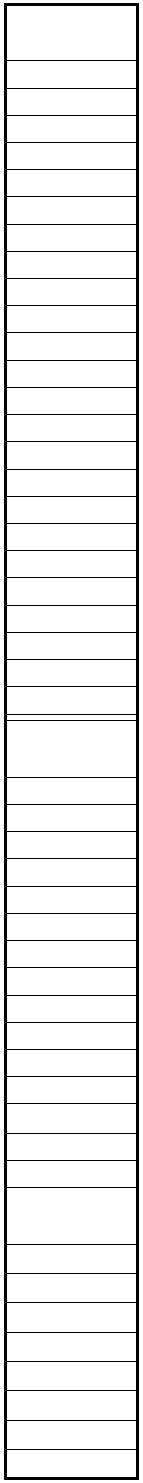
MO Households with Computers	1,125,827	Calculated by taking U.S Census Bureaus 2000					
Percent of MO households w/a computer	51.30%	Estimate that in the Midwest region, 51.3% of					
		households have at least one computer.					
		So 51.3% x 2,194,594 =					
If you were to take the results of my							
survey and apply them to the this study:							
My survey reports that of the families that							
have computers:			total MO Computers				
76%	59	have 1	851,587.09				
21%	16	have 2	230,938.87				
3%	2	have 3	28,867.36				
1%	1	have 4	14,433.68				
1%	1	have 5	14,433.68				
			1,140,260.68	total			

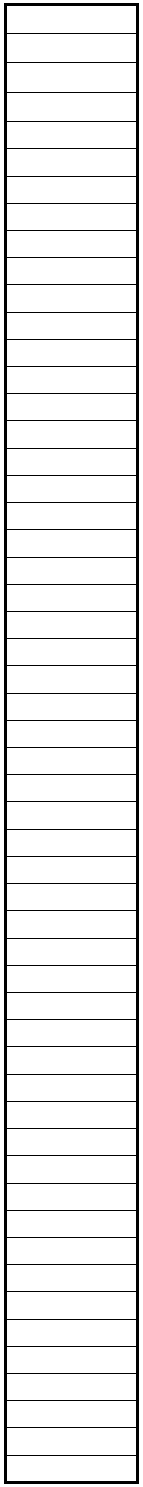
My Estimate of businesses: # of computers and obsolete

1) Within the 143,912 establishments, there are 2,301,122 employees							
2) It is estimated that							
				#########			

					########		
					########		
	10 years	per year	per day				
	9,950,000	995,000	2,726				
This is just for computers and monitors;	666,650,000	66,665,000	182,644				
Between the years of 1997 and 2007 (ten year period) it is estimat	333,325	33,333	91				
Based on if all were recycled:							
the state of Mo.'s portion (1.99% of total)='s							
This may not be far off, as other studies suggest that in the year 2002,							
as many computers will become obsolete as new ones will be sold.							
	6,467,500	646,750	1,772				
What does this equal by weight:	216,661	21,666	59				
If each computer/monitor averages 67lbs							
tons:							
What does this mean then for the relationship							
between what MO uses and that which goes to							
Asia. If between 50-80% of e-waste							
collected goes to Asia, use 65%							
# of computers:							
tons:	Plastic	lead	cadium	chromium	mercury		
	###########	1,580,000,000	3,000,000	1,900,000	632,000		
	125,768,000	31,442,000	59,700	37,810	12,577		
	12,576,800	3,144,200	5,970	3,781	1,258		
	34,457	8,614	16	10	3		
Now figure how much plastics, lead, cadium,							
chromium, mercury Mo send over							
If 500M computers ='s (in lbs)							
So MO's share is 1.99%							
10 years							
1 year							
each day							
Using National Safety Councils Convertion Model with updated numbers							
Estimate # of computers becoming obsolete year 2001 - through 2007							
	Year	Units shipped	Average Life Span	3 years	2.5 years	2 years	# obsol
	2001	43,800,000	2.8				
	2002	41,610,000	3.0				
	2003	43,690,500	3.0				
	2004	45,990,000	2.5				
	2005	48,289,500	2.0				
	2006	50,703,975	2.0				
	2007	53,239,174	2.0				
	this is the original NSC Table 6 (page 29) estimate of future obsolescnece						
	Year	Units shipped	Average Life Span	5years	4 years	3 years	2 years
	1992	11,500,000	4.5	50.00%	50.00%		

	1993	14,600,000	4.2	20.00%	80.00%		
	1994	15,800,000	4.1	10.00%	90.00%		
	1995	17,100,000	3.8		80.00%	20.00%	
	1996	21,400,000	3.6		60.00%	40.00%	
	1997	31,400,000	3.4		40.00%	60.00%	
	1998	36,700,000	3.2		20.00%	80.00%	
	1999	42,600,000	3.1		10.00%	90.00%	
	2000	48,900,000	2.8			80.00%	20.
	2001	49,900,000	2.6			60.00%	40.
	2002	52,000,000	2.4			40.00%	60.
	2003	53,300,000	2.2			20.00%	80.
	2004	54,600,000	2.1			10.00%	90.
	2005	55,800,000	2.0				100.
	2006	58,590,000	2.0				100.
	2007	61,519,500	2.0				100.
		625,709,500					
	this is NSC's table with my new numbers						
	Year	Units shipped	Average Life Span	5years	4 years	3 years	2 years
	1992	11,500,000	4.5	50.00%	50.00%		
	1993	14,600,000	4.2	20.00%	80.00%		
	1994	15,800,000	4.1	10.00%	90.00%		
	1995	17,100,000	3.8		80.00%	20.00%	
	1996	21,400,000	3.6		60.00%	40.00%	
	1997	31,400,000	3.4		40.00%	60.00%	
	1998	36,700,000	3.2		20.00%	80.00%	
	1999	42,600,000	3.1		10.00%	90.00%	
	2000	48,900,000	2.4			40.00%	60.
	2001	43,800,000	2.8			80.00%	20.
	2002	41,610,000	2.4			40.00%	60.
	2003	42,442,200	2.4			40.00%	60.
	2004	45,837,576	2.6			60.00%	40.
	2005	49,504,582	2.6			60.00%	40.
	2006	53,464,949	2.4			40.00%	60.
	2007	58,811,444	2.4			40.00%	60.
	total Shipped	575,470,750					Total C
	So, based on new figures - which are different for NSC's starting in year 2001 and showing less						
	total number becoming obsolete, is closer to 428,000 and not the 500,000 as previousl anticipate						
	of less units being sold and people holding on to computers longer.						





17,500,000
20,600,00
23,800,000
31,600,000
41,900,00
55,400,000
63,300,000
61,100,000
63,400,000
59,800,000
61,300,000

My Estimate of how many MO households have computers

MO Households with Computers	2,194,594	Calculated by taking U.S Census Bureaus 2000
Percent of MO households w/a computer	51.30%	estimate that in the Midwest region, 51.3% of
Total households with at least one computer	1,125,827	households have at least one computer.
		So 51.3% x 2,194,594 MO households =

So, how many computers are there applying my survey to the # of households:

If you were to take the results of my survey and apply them to the this study:
My survey reports that of the families that have computers:

			total MO Computers	
76%	59	have 1	851,587.09	
21%	16	have 2	230,938.87	
3%	2	have 3	28,867.36	
1%	1	have 4	14,433.68	
1%	1	have 5	14,433.68	
			1,140,260.68	total

# of Computers in the household	% of MO Having that many	Total MO families having that many	Subtotal computers
1	76%	855,629	855,628.52
2	21%	236,424	472,847.34
3	3%	33,775	101,324.43
4	1%	11,258	45,033.08
5	1%	11,258	56,291.35
		Total Computers	1,531,124.72

calculating numbers based on my surveys:

If I iinterviewed 155 businesses, this what? % of all MO. busines	0.11%
If I iinterviewed 120 households, this what? % of all MO. HH's?	

Appendix I: NSC Baseline Table 6 and Modified Estimates

This is the original NSC, Estimate of Future Obsolescence, as it appears in Table 6 of The Baseline Report.

			Share of PC's Lasting					
Year	Units shipped	Average Life Span	5years	4 years	3 years	2 years	Number Obsolete	
1992	11,500,000	4.5	50.00%	50.00%				
1993	14,600,000	4.2	20.00%	80.00%				
1994	15,800,000	4.1	10.00%	90.00%				
1995	17,100,000	3.8		80.00%	20.00%			
1996	21,400,000	3.6		60.00%	40.00%			
1997	31,400,000	3.4		40.00%	60.00%		17,430,000	
1998	36,700,000	3.2		20.00%	80.00%		20,560,000	
1999	42,600,000	3.1		10.00%	90.00%		23,820,000	
2000	48,900,000	2.8			80.00%	20.00%	31,680,000	
2001	49,900,000	2.6			60.00%	40.00%	41,920,000	
2002	52,000,000	2.4			40.00%	60.00%	55,460,000	
2003	53,300,000	2.2			20.00%	80.00%	63,340,000	
2004	54,600,000	2.1			10.00%	90.00%	61,140,000	
2005	55,800,000	2				100.00%	63,440,000	
2006	58,590,000	2				100.00%	59,800,000	
2007	61,519,500	2				100.00%	61,260,000	
Totals:	625,709,500						499,850,000	

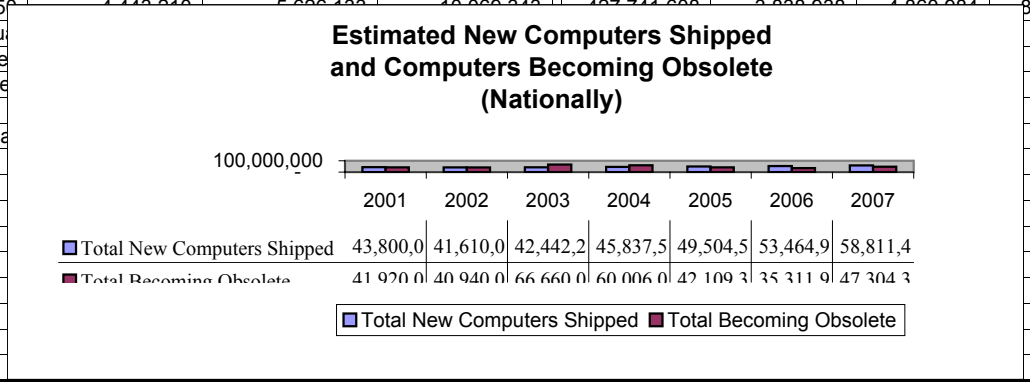
This is the modified Estimate of Future Obsolescence data used for this study.

				Share	of PC's	Lasting		Of Number Obsolete,
Year	Units shipped*	Avg. Life Span**	5years	4 years	3 years	2 years	Number Obsolete	Number Not Recycled
1992	11,500,000	4.5	50.00%	50.00%				(Based on NSC Estimate)
1993	14,600,000	4.2	20.00%	80.00%				
1994	15,800,000	4.1	10.00%	90.00%				
1995	17,100,000	3.8		80.00%	20.00%			
1996	21,400,000	3.6		60.00%	40.00%			
1997	31,400,000	3.4		40.00%	60.00%		17,430,000	15,512,700
1998	36,700,000	3.2		20.00%	80.00%		20,560,000	18,298,400
1999	42,600,000	3.1		90.00%	10.00%		23,820,000	21,199,800
2000	48,900,000	2.4			40.00%	60.00%	31,680,000	28,195,200
2001	43,800,000	2.8			80.00%	20.00%	41,920,000	37,308,800
2002	41,610,000	2.4			40.00%	60.00%	40,940,000	36,436,600
2003	42,442,200	2.4			40.00%	60.00%	66,660,000	59,327,400
2004	45,837,576	2.6			60.00%	40.00%	60,006,000	53,405,340
2005	49,504,582	2.6			60.00%	40.00%	42,109,320	37,477,295
2006	53,464,949	2.4			40.00%	60.00%	35,311,910	31,427,600
2007	58,811,444	2.4			40.00%	60.00%	47,304,378	42,100,897
Totals:	575,470,750						427,741,609	380,690,032

*Includes homes, businesses, governments and schools.

**Life span is adjusted to include governments and schools which hold on to computers longer..

Year	Number Shipped Nationally	# Estimate Shipped to MO Households	# Estimate Shipped to MO Businesses	Total Estimated Shipped to MO	Number Obsolete Nationally	# HH Obsolete In Missouri	# Business Obsolete MO	MO Total Obsolete
1997	31,400,000	281,812	356,839	638,651	17,430,000	156,433	198,080	354,512
1998	36,700,000	329,379	417,070	746,449	20,560,000	184,524	233,650	418,174
1999	42,600,000	382,331	484,119	866,450	23,820,000	213,782	270,698	484,480
2000	48,900,000	438,873	555,714	994,587	31,680,000	284,325	360,021	644,346
2001	43,800,000	393,101	497,756	890,857	41,920,000	376,228	476,391	852,619
2002	41,610,000	373,446	472,869	846,314	40,940,000	367,432	465,254	832,687
2003	42,442,200	380,915	482,326	863,240	66,660,000	598,267	757,544	1,355,811
2004	45,837,576	411,388	520,912	932,300	60,006,000	538,548	681,926	1,220,474
2005	49,504,582	444,299	562,585	1,006,884	42,109,320	377,927	478,543	856,470
2006	53,464,949	479,843	607,592	1,087,434	35,311,910	316,921	401,295	718,216
2007	58,811,444	527,827	668,351	1,196,178	47,304,378	424,552	537,581	962,133
10 Yr Perioc	495,070,75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8,699,922
Number of Obsolete Will Equ								
Of Obsolete Nationally Divide								
Household and 54.9% Busine								
Then National HH x 1.99 %, a								
National Busimess x 2.07%								



This is an estimate of "Obsolete-Recycled" vs. "Obsolete-NOT" in Missouri. Based on National numbers, tempered by my surveys and other reports.

	Nationally #	Nationally # Of	MO.	MO. Obsolete	MO. Compts	MO. Monitors	MO. Monitors	MO. Peripherals	MO. Peripherals	MO TV's	MO TV's	MO. All	MO. All	MO. Solid	Elect. %
	Of Obsolete	Obsolete Computer	Obsolete	Computers	Not recycled	Not Recycled	Not Recycled	not reycled	not reycled	Not Recyled	Not Recyled	Not Recycled	Not Recycled	Waste	SolidWa
Year	Computers	Not Recycled	Computers	Not Recycled	in Tons	in Units	in Tons	In units	In Tons	in units	tons	In units	In tons	Landfilled	in Landf
1997	17,430,000	15,512,700	354,512	315,516	10,570	261,766	4,581	153,764	1,922	156,181	7,028	887,226	24,101	4,118,739	0.59%
1998	20,560,000	18,298,400	418,174	372,175	12,468	290,851	5,090	170,849	2,136	173,534	7,809	1,007,409	27,502	4,464,357	0.62%
1999	23,820,000	21,199,800	484,480	431,187	14,445	314,119	5,497	183,683	2,296	206,158	9,277	1,135,147	31,515	4,570,496	0.69%
2000	31,680,000	28,195,200	644,346	573,468	19,211	339,248	5,937	198,377	2,480	222,651	10,019	1,333,744	37,647	4,759,493	0.79%
2001	41,920,000	37,308,800	852,619	758,831	25,421	366,388	6,412	214,247	2,678	240,463	10,821	1,579,929	45,332	4,949,873	0.92%
2002	40,940,000	36,436,600	832,687	741,091	24,827	395,699	6,925	231,387	2,892	259,700	11,687	1,627,877	46,330	5,147,868	0.90%
2003	66,660,000	59,327,400	1,355,811	1,206,672	40,424	427,355	7,479	249,898	3,124	280,476	12,621	2,164,401	63,647	5,353,782	1.19%
2004	60,006,000	53,405,340	1,220,474	1,086,222	36,388	461,543	8,077	269,890	3,374	330,452	14,870	2,148,107	62,709	5,567,934	1.13%
2005	42,109,320	37,477,295	856,470	762,258	25,536	498,467	8,723	291,481	3,644	356,888	16,060	1,909,094	53,962	5,790,651	0.93%
2006	35,311,910	31,427,600	718,216	639,212	21,414	538,344	9,421	314,800	3,935	385,439	17,345	1,877,795	52,114	6,022,277	0.87%
2007	47,304,378	42,100,896	962,133	856,298	28,686	581,412	10,175	339,983	4,250	416,274	18,732	2,193,967	61,843	6,263,168	0.99%
For 10	427,741,608	380,690,031	8,699,922	7,742,931	259,388	4,475,192	78,316	2,618,359	32,729	3,028,216	136,270	17,864,697	506,703	57,008,637	

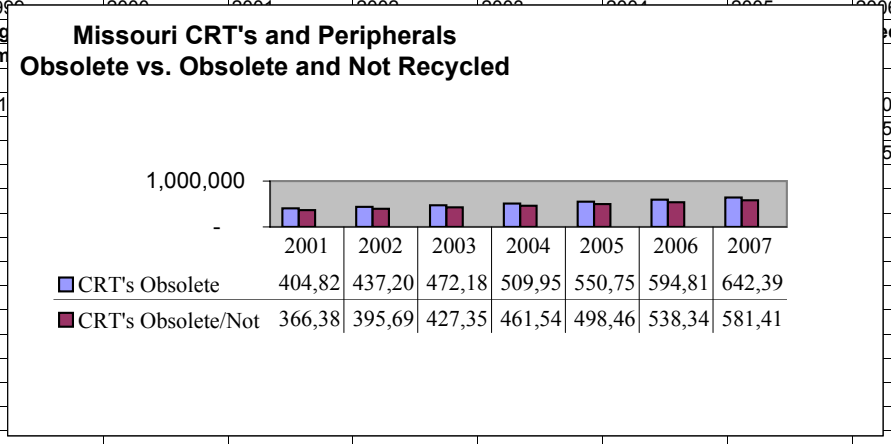
* For 1997 monitors and peripherals, TV's I back in to it using 1998 #'s less 8%

**total solid waste in MO landfills from 1997-2000 is as perMissouri Waste Diversion Status report From 2001-2007 I added 4% each year

***Does not include household or other consumer electronics which could add .19% to totals

****All based on the assumption that all obsolete, nonrecycled stuff is dumped

This report shows number of Obsolete vs. Recylced Monitors/TV's/ Peripherals Nationally and for MO by units and weight in tons											
NSC Baseline Report on all electronic products recycled. 1998 #'s came from NSC											
Then used an 8% increase each subsequent year (chose 8% because estimates range											
from 5%-18% which equals 11.5% then adjusted down											
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CRT's: Recycled vs. not recycled percentage is based on NSC 1998 #'s. NSC said 15.8 million became obsolete in'98 and only 1.5 m were recycled											
MO. Obsolete is determined by taking national total x (45.1%HH) x 1.99%; + national total X (54.9% business) x2.07%											
National crt's obsolete		15,800,000	17,064,000	18,429,120	19,903,450	21,495,726	23,215,384	25,072,614	27,078,423	29,244,697	31,584,273
National crt's recycled		1,500,000	1,620,000	1,749,600	1,889,568	2,040,733	2,203,992	2,380,311	2,570,736	2,776,395	2,998,507
National crt's not recycled		14,300,000	15,444,000	16,679,520	18,013,882	19,454,992	21,011,391	22,692,303	24,507,687	26,468,302	28,585,766
National Weight in tons35lbs)	35	250,250	270,270	291,892	315,243	340,462	367,699	397,115	428,885	463,195	500,251
MO. Crt's obsolete		321,359	347,068	374,834	404,820	437,206	472,182	509,957	550,753	594,814	642,399
MO crts recycled		30,509	32,950	35,585	38,432	41,507	44,827	48,414	52,287	56,470	60,987
MO crt's not recylced		290,851	314,119	339,248	366,388	395,699	427,355	461,543	498,467	538,344	581,412
MO CRT's not recycled in TONS		5,090	5,497	5,937	6,412	6,925	7,479	8,077	8,723	9,421	10,175
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
*** MO Obsolete tv's based on TV's equalling 60% of monitors with an annual increase of 10% until 2004; then a 20% increase due**											
***MO recycled =s total obsolete X 10% which is the same ratio for monitor**											
*** TV weight based on Minn. Demonstration prc**											
MO's tv's obsolete		192,816	229,065	247,390	267,181	288,556	311,640	367,169	396,542	428,266	462,527
MO TV's recycled		19,282	22,906	24,739	26,718	28,856	31,164	36,717	39,654	42,827	46,253
MO TV's not recylced		173,534	206,158	222,651	240,463	259,700	280,476	330,452	356,888	385,439	416,274
MO TV's not recycled in TONS	90	7,809	9,277	10,019	10,821	11,687	12,621	14,870	16,060	17,345	18,732
		1998	199							06	2007
Peripherals: Recycled vs. not recycled percentag										**ecycled.**	
This is 74% not recycled. MO. Obsolete is determ											
Showing an 8% increase each year											
National peripherals obsolete		11,300,000	1							0,915,511	22,588,752
National peripherals recycled	25	2,900,000								5,438,033	5,873,076
National peripherals not recycled		8,400,000								5,477,478	16,715,677
National Weight in tons(25lbs)		105,000								193,468	208,946
MO. peripherals obsolete		229,833								425,405	459,437
MO peripherals recycled		58,984								110,605	119,454
MO peripherals not recylced		170,849								314,800	339,983
MO peripherals not recycled in TO		2,990								5,509	5,950



Appendix II: What's In Our PCs? Source: Microelectronics and Computer Corporation (MCC) 1996. Printed without permission

Appendix III: How Revenues Are Calculated For the Electronics Demanufacturing/Recycling Model

Step #1: Calculate total tons for each material type based on percentage of total for each equipment type, based on Chart H2.

* For example, computers make up 52% of the total equipmer	Percent Of Total	Tons For Each Type
collected, and total 4,184 tons.		
Computers	52%	4,184
CRT-Monitors	14%	1,126
CRT-TV	24%	1,931
Peripherals	8%	644
Misc. E's	1.5%	121
Major Parts	0.5%	40
	100%	8,046

Step #2: Since CRT's are treated differently, determine the total electronics, less CRT's, that will be reued and recycled.
Simply taking out the 1,126 tons of CRT-monitors and the 1,931 tons of CRT-TV's.

	Percent Of Total	Tons Per Type Of Equipment	Tons Recycled	Tons Reused
Computers	52%	4,184	4,079	102
Peripherals	8%	644	611	31
Misc. Electronics	1.5%	121	115	6
Major Parts	0.5%	40	38	2

Step #3: Determine revenues from recycables. The equipment listed in #2 will be broken down into the following categories, with the corresponding revenues and percent of total materials.

*For example, "Electronic Scrap" yields 4¢ a pound, makes up	Price Per Pound	Percent Of All Materials	Total Tons Per Type	$'s Generated Per Type
24% of all recycable materials, generating $95,789.				
Electronic scrap	$0.04	24%	1,197	$95,789
CPU's	$0.06	32%	1,596	$191,578
Printers	$0.00	28%	1,397	$0
Keyboards/Mice	$0.00	2.10%	105	$0
Copiers	$0.00	3.70%	185	$0
Hard drives	$0.14	2.70%	135	$37,717
Telephones	$0.06	0.90%	45	$5,388
Power Supplies	$0.02	1.80%	90	$3,592
Insulated Wire	$0.10	1.20%	60	$11,974
Mixed boards	$0.60	0.90%	45	$53,881
Low grade boards	$0.20	0.90%	45	$17,960
Medium grade boards	$0.60	0.75%	37	$44,901
High grade boards	$1.25	0.60%	30	$74,835
Super grade boards	$2.50	0.45%	22	$112,253
Totals (Excluding CRT's):			4,989	$649,867

Step #4: Determine both tons and units of CRT's that are recycled and reuse.

	Weight Per CRT Type	Total Tons Per CRT Type	Tons Recycled	Tons Reused	Units Recycled	Units Reused
CRT-Monitors	30	1,126	1,070	56	71,313	3,753
CRT TV's	90	1,931	1,912	19	42,482	429
Totals For CRT's		3,057	2,981	76	113,795	4,182

Step #5: Figure revenue from collection fees without a ban on CRT's in Missouri.

Based on a collection fee of $9 per CRT or TV.	Recycled	Reused	Total	$'s Generated
Total CRT and TV's Collected:	113,795	4,182	117,978	$1,061,800

Although an estimated 117,978 CRT-monitors and TV's will potentially become available, it is estimated that only 50% will be collected because there is not a regulated ban in place.

Units Collected (this will be factor at 50% of #5 totals):	56,898	2,091	58,989	$530,900

Step #6: Determine revenue generated from the sale of reusable systems parts and componets.

* For example, 105 tons of reusable computers will equal	Tons That Are Reused	Weight Per Equipment Type	Total Units Per Type	Average Price Per Type	Total Revenue Per type
3,487 computer units generating $522,990.					
Computers	105	60	3,487	$150	$522,990
Monitors	56	30	3,733	$55	$205,333
Peripherals (merging ofall)	32	25	2,575	$30	$77,242
Misc. Electronics	6	15	805	$20	$16,092
Major Parts	2	1	4,023	$9	$36,207
TV's	19	90	422	$35	$14,778
Total:					$872,642

Revenue From all Sources for Demanufacturing Model	
Recyclables	$649,867
Collection	$530,900
Reuse	$872,642
Total:	$2,053,409

Complete Computer Systems Including CPU, Monitor, Keyboard and Mouse	Value	Average Weight in Pounds	% of All Reused Items	Total Weight Per Item Type	Total Units	$'s Generated Per Item Type
Pentium 133	$100					
Pentium 166	$125					
Pentium 233	$175					
Above P-233 average	$425					
Average older Mac system (6100-8100)	$75					
Average newer Mac system (9100 +)	$175					
Laptop PC (average of all)	$200					
Laptop Mac PowerBooks (average of all)	$125					
Average Price (adjusted down)	**$150**	60	52%	418,392	6,973	$1,045,980
Monitors						
14"	$45					
15"	$55					
17"	$75					
19" or larger average price	$175					
	$55	30	14%	337,932	11,264	$619,542
Printers						
HP LaserJet's (average of all)	$125					
Non HP LaserJet's (average of all)	$85					
Inkjet (average of all)	$35					
Average Price (adjusted down)	**$35**	25	6%	144,828	5,793	$202,759
Scanners						
Older	$15					
Newer	$25					
Average Price	**$20**	15	1%	24,138	1,609	$32,184
Fax						
Thermal	$35					
Plain paper	$60					
All-In-One	$125					
Average Price (adjusted down)	**$35**	17	1%	24,138	1,420	$49,696
TV's						
Working Television	$35	90	24%	386,208	4,291	$150,192
	Value	Average Weight in Pounds	% of All Reused Items	Total Weight Per Item Type	Total Units	$'s Generated Per Item Type
Miscellaneous						
Electric typewriters	$20					
Overhead or slide projector	$50					
CD burners	$55					
Speakers	$5					
Individual phones	$5					
Phone System	$250					
Average Price (adjusted down)	**$25**	15	1.5%	36,207	2,414	$60,345
Major Parts and Components						
Hard drives, below 1 Gig	$10					
Hard drives, above 1 Gig	$25					
Keyboards	$5					

Appendix V
ACKNOWLEDGEMENTS

Special thanks to:
- *Julie Rhodes, Executive Director, The Reuse Development Organization)*
- *Leann Ritter, Community Development Coordinator, Surplus Exchange*
- *Lisa Danbury, Environmental Planner, Mid-America Regional Council*

Thank you:
- *David Flora, Solid Waste Program Manager, U.S. EPA Region 7*
- *Laura Newman, Saint Louis Department of Health*
- *The Surplus Exchange Staff*
- *Tom Jacobs, Mid-America Regional Council*
- *Tom Kacandes, TKM Materials*
- *Missouri Department of Natural Resources*
- *Lynn Rubenstein, Executive Director, Northeast Recycling Council, Inc.*
- *Edward Campbell, The Per Scholas Recycling Facility*
- *Sheila Davis, Development Director, Materials for the Future Foundation*
- *Missouri businesses and households participating in the study*

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Mr. Caplan is currently providing strategic-business planning and start-up technical assistance to reuse and recycling businesses and organizations. Mr. Caplan is the former Executive Director of the Surplus Exchange. He developed the *Learn and Earn Computer Education Program*, teaching youth, adults and families to build their own computers, which they then get to keep for educational and occupational use. He also developed the *DEALS (Developing Earning And Learning Skills),* Appliance Reuse and Recycling Center in Kansas City, Missouri. In addition, Mr. Caplan provides consulting and business training to nonprofit organizations of all types.

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